
Electrical Engineering
July 1939
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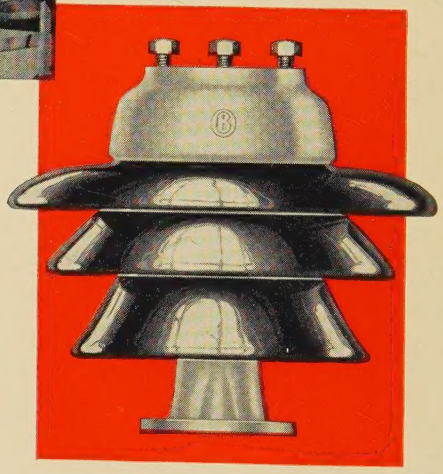

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Electrical Engineering

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for July 1939—

The Cover: A view in a crossbar dial-switching telephone plant. This new switching system, now being placed in operation on the Bell System, was described in the TRANSACTIONS section of the May issue, pages 179-92

Transactions Section *(Follows EE page 324)*

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High Lights

Inductive Co-ordination. Introduction of the sodium-vapor lamp for highway lighting produces new problems of noise induction on telephone lines because of the wave-shape characteristics of the lamps. Co-ordination of the systems from the noise standpoint is necessary where series circuits supplying many such lamps are involved in exposures with open-wire telephone lines (*Transactions pages 325–32*).

Solar Energy. In discussing experiments on the utilization of the heat from the sun, a noted authority on this subject says that the State of New Mexico could supply from solar radiation more energy than is now obtained from all coal, oil, and water at present used annually for heat, light, and power combined in the United States (*pages 294–8*).

Polyphase Broadcasting. A system of amplitude-modulated radiobroadcasting that compares with present-day broadcasting much as a polyphase generator compares with a single-phase generator offers the possibility of reducing the capacity of the final power amplifier, for a given transmitter power rating, to half that now required (*Transactions pages 347–50*).

Conservators of Capital. "Literally no one can escape the personal effect from continued Government spending in excess of a level of tax earnings that is already up to about the limit that industry can carry," says a prominent engineer, who urges engineers, as natural conservators of capital, to "sound the alarm" (*pages 291–3*).

New AIEE Officers. Among other items of business at the annual meeting of the AIEE held during the combined summer and Pacific Coast convention just concluded in San Francisco, Calif., was the announcement of the election of new officers for the administrative year beginning August 1 (*page 301*).

District Meetings. Plans are actively in progress for two AIEE District meetings: one will be held September 27–29 by the Great Lakes District at Minneapolis, Minn. (*page 303*); the other October 11–13 by the Middle Eastern District at Scranton, Pa. (*pages 303–04*).

Directors Report. The annual report of the AIEE board of directors to the membership for the fiscal year ending April 30, 1939, is included in full in this issue. It contains brief reports of the various Institute committees and the usual financial tabulations (*pages 305–17*).

Carrier System. A carrier telephone system for open-wire lines that extends the frequency range from about 30 kilocycles, the highest previously used, to more than 140 kilocycles adds 12 more channels to the four already furnished by each pair of wires (*Transactions pages 351–60*).

Stray Load Loss. Experimental work indicates that determination of the stray load loss in induction machines by reverse-rotation test, in which the machine is driven at synchronous speed opposite to its normal direction of rotation, is simple and accurate (*Transactions pages 319–24*).

Electromagnetic Horns. Ultrahigh-frequency electromagnetic waves may be transmitted and received using flared horns of metal as antennas. Principles of design for sectoral and pyramidal horns are given in a paper in this issue (*Transactions pages 333–8*).

Social Obligations. Some thoughts on the social obligations of engineers expressed in an address by AIEE President John C. Parker at a recent District meeting may give other members food for thought (*pages 285–6*).

Highway Lighting. So-called "traffic safety lighting," which renders the road surfaces bright so that objects are seen in silhouette, is reducing automobile traffic fatalities markedly in cities where it has been applied (*pages 287–90*).

Gas-Filled Cables. Inert gas at pressures in the range from about 10 to 15 pounds per square inch is used as the pressure medium in a new high-voltage cable which, from an economic standpoint, may be used at 40 kv or less (*Transactions pages 307–18*).

News 301

Cold-Cathode Tubes. Gas-filled tubes that require no cathode heating may be useful circuit elements where currents do not exceed 100 milliamperes. Functions include action as a relay, a rectifier, or a voltage regulator (*Transactions pages 342–7*).

Electric Drives. Supercalenders, which are used to give a high surface finish to paper, are examples of machines for which electric motors are required to provide unusual flexibility (*Transactions pages 338–41*).

Welder Control. Electronic timing control for resistance welders has been extended economically to small welders by a circuit employing recently developed types of cold-cathode tubes (*Transactions pages 361–4*).

Synchronous-Machine Calculations. A simplified method of calculating curves of terminal voltage versus field current for various overexcited power factors has been devised (*pages 299–300*).

Standards Subcommittee. Among the co-ordinating subcommittees recently appointed to broaden the standards work of the AIEE is one to co-ordinate reference values (*page 304*).

A-C Welding. Arc welding with alternating current has been improved by circuits that prevent the open-circuit voltage from rising to dangerous values (*Transactions pages 364–70*).

Coming Soon. Among special articles and technical papers now undergoing preparation for early publication are: an article describing the electrical features of the Union Pacific's new steam-electric locomotive; an article defining the unit "decibel" in simplified language, by H. P. Lawther (A'28); an article presenting simplified computations of voltage regulation, by R. D. Evans (M'26); an article describing a method for determining the efficiencies of small motors from the heat due to eddy currents, by J. L. C. Löf, current recipient of the AIEE national prize for Branch paper; a paper on multiple-grid circuit breakers by J. B. MacNeill (M'36) and A. W. Hill (A'38); papers describing air circuit breakers by L. R. Ludwig (A'28) and G. G. Grissinger (M'38), and R. C. Dickinson (A'37); a paper on power system transients caused by switching and faults by R. D. Evans (M'26), A. C. Monteith (A'25), and R. L. Witzke (A'37); a paper on power-system voltage-recovery characteristics by H. A. Peterson (A'35); a paper on the effect of restriking on recovery voltage by C. Concordia (M'37) and W. F. Skeats (M'36); a paper on the influence of resistance on switching transients by R. C. Van Sickle (M'37); and a paper on overvoltages during power-system faults by Edith Clarke (M'33), S. B. Crary (M'37), and H. A. Peterson (A'35).

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Some Thoughts on the Social Obligations of Engineers

JOHN C. PARKER
PRESIDENT AIEE

MEMBERS of the engineering profession are becoming increasingly sensitive to their social obligations both collectively and individually. This is no new thing in the profession. Indeed for as far back as I can remember, engineers have questioned whether the profession occupied the place that it should have in organized society, and to a degree whether it was discharging its obligations to society. The creation of the American Engineering Council gives organic expression to this concern on the part of the profession.

It is natural that in recent years we should have seen an intensification of interest in the social status of the profession. All sorts of things today are being appraised in the light of their social implications, and engineering as a vital process scarcely could be expected, if engineers wished it, to remain aloof from the current trends.

In the profession, as in the general activities of society, we will be helped in our appraisals if we are somewhat careful in our definition of terms. The words "social" and "socialization" carry good implications. They are nice words just as are "individualism" and "initiative." It is rather important that accepting these words in the first instance in their direct and good denotation we do not automatically transfer to their somewhat different connotations the same excellences. This is no matter of word splitting but an essential part of clear-headed thinking.

In recent years we have heard more and more talk about the socialization of this, that, and the other thing. If by socialization we mean the rendering of an institution or of a process truly social in its effects and in its objectives, that is one thing. If by socialization we mean a particular and specific process of attaining professed objectives, that well may be quite another thing.

No intelligent man of good will can for a moment object to a philosophy that holds the justifiable purposes of life to be unselfish, to spread out to the general social body rather than defensibly centering in the individual. This is socialization in its truest sense. The concentrating of more and more power in institutions, the organization of conduct by rules and processes and formulas is not necessarily social. Indeed it may be quite antisocial.

The highest individualism is necessarily fully social. Collectivism may easily be unsocial or antisocial.

A little while ago we heard from Soviet Russia much of the socialization of the family. Had that meant that no family unit any more than an individual has a right to be egocentric, there could have been no quarrel with it. The communization of families was quite a different thing.

In the United States we are today hearing much about the socialization of medicine. If by that we mean the development of more truly social objectives and a more practical realization of them, we are talking of a philosophy which all good men must endorse. In practice, what is called socialized medicine may become collectivized medicine and may run definitely counter to its professed objectives.

So, with the socialization of industry, we may hope for a closer and closer approach to the professional viewpoint that all industry exists for and must be directed to the benefit of the maximum number of the members of the society. This does not necessarily mean the abolition or the restriction of individual ownership, management, or direction, which may result in a collectivization with less in the true sense of socialization.

I think we have a sufficiency of illustrations at hand that the collectivization of the education, the culture, the economy of a country well may concentrate so much power in an irresponsible body politic that the ends of an antisocial government more easily may be achieved, possibly even to the destruction of our civilization.

Now let us take a look at our profession from the viewpoint of socialization. Certainly as one views our heritage in the work of the fathers, we may claim that our origins at least have been magnificently social. The work of Maxwell and of Hertz and of Faraday represented a search for the truth quite unaffected by any slightest element of self-interest—the truth for its own sake and to be shared generously with all mankind. Even in the joy of discovery—in the satisfactions of their scientific pursuits—these men did not seek selfishly to clutch to their own bosoms that which they had created. They sought rather to give it to the world, and no one will deny that the generations past and to come magnificently have been enriched by their sense of social obligation.

Later came other researchers, designers, and inventors. These too sought to create for the service of the race comforts and utilities that would ameliorate living. They handed on their work to you and to me to give extension and realization to what they initiated. Truly this was a socialized practice as well as a social philosophy.

Coming down to current experience, I ask you to examine your own hearts and minds and the conduct of your brother-engineers as to the objectives which you recognize in yourselves—which you find in your fellows.

Address presented at the general session of the AIEE North Eastern District meeting, Springfield, Mass., May 4, 1939.

Is it the attainment of position or acclaim or monetary reward which most actuates engineers, or is it the satisfaction of creation and the realization that that creation serves those who may know little and care less about our processes but who, nonetheless, are the beneficiaries of what we do? On this self-searching, I think we must find that we are practicing an already socialized profession.

At times the more sensitive among us deplore that engineers are not engaged in an individual-service profession wherein a genuinely professional and social objective may as obviously express itself as in such a profession as medicine.

I suppose that in our electrical branch of the profession the preponderance of our membership finds itself working under corporate organization and that easily we can come to think of ourselves as working for those corporations rather than for society, while just as easily we can emotionalize or idealize the work of the doctor and think of him as working entirely for his patients and not at all for himself.

We must admit that it is easier for the individual outside the great business organizations consciously to direct his influence toward social objectives—that with reference to his own work he can make his own philosophy of service a more potent factor in determining its complexion. On the other hand, it is equally to be recognized that a man whose principal living comes from a salaried job is free from the pressure to make each individual act, each particular transaction, serve his own selfish necessities. I wonder whether a representative number of engineers picked at random in one of our great manufacturing or other corporate enterprises would not be found on the average to be as detached and as professional in their approach to their work as an equal number of men similarly selected from any one of the personal-service professions?

Indeed this matter of corporate employment automatically creates a tendency toward socialized operation.

May I for a minute come back to the consideration of mere words as perhaps being indicative of a philosophy. Not so many years ago we commonly spoke of a certain type of enterprise as a public-service corporation. This phrase in and of itself denotes social consciousness. Indeed it denotes a realization of social obligation to serve. More recently the older name has given place to that of public utility which again is just another way of saying "usefulness to the public."

I do not believe for a moment that engineers in the type of employment in which I have been engaged are uniquely set apart from other engineers in corporate enterprise in the matter of rendering a genuine social service through the work of the firms with which they are connected. I make no attempt to claim that the American business system founded on the profit motive and with a great deal of emphasis on private initiative ever has been or is today entirely or even primarily altruistic; but I do insist that in effect the business corporations which engage the services of engineers have been dominated by a realization that a maximum of profit for the owners could result only from a broad dissemination of the products, and that this in effect has led to a high type of realistic socialization of the work of the engineers.

The arts of communication, including radio broadcasting, our great systems of transportation, the well-nigh universal automobile all are cases in point. It is true that the distribution of these devices has not become quite universal. It well may be that the rewards of industry in their production are not ideally distributed. It is a fact that some individuals have made vast fortunes out of their development. The fact not so commonly recognized is that the private wealth so accumulated has not been taken out of the general run of society except in the sense that society has passed back to those who had a hand in these developments a portion of what the developments gave to society.

We miss at times the fact that society did get along before it had the incandescent lamp; that we would have been as well off without the development of the radio systems as we were before they came into existence; that people did live for a great many centuries before the countryside was sprinkled with automobiles. The inventors, the designers, the promoters of these devices working in corporate enterprise created things which the society generally felt to be worth while, and the very fact of their wide distribution under a system of free economy is a pretty clear indicant that a highly socialized service was rendered in adding them to the convenience and comfort of living.

So too it seems to me that the products of engineering skill which flow through corporate enterprise to the less immediate service of human desires and human needs are as truly a socialized service. Because of the very process of distribution, with all of its imperfections, I cannot feel that we have other than a highly socialized profession susceptible of vast improvement through the processes of evolutionary selection guided by a more and more acute social consciousness on the part of the practitioners.

This social consciousness I believe cannot come about through the resolutions of organizations or the statutes of legislators, but will develop with us as it already has developed among us and in the other professions, through the extension to the body of the profession of the spirit which was in the founders. This is a matter of individual growth without which all the mechanism of socialization can accomplish nothing except to set up a machinery. Perhaps the greatest evil of collective operations is in the very fact that they do represent a mechanism for effectuating the purposes of the average, and that by the very process of mechanization the average is lowered by restraint of the best elements in the group.

My own great hope for our profession lies in the fact that there is so much questioning today of the social character of the performance of the engineer. In the very raising of such question we are forced to direct our minds to the things that we as individuals can do more nearly to emulate the notable examples of social direction which already exist in our history and currently among us. Doing that, whatever the nature of our engagement by the society, we are bound to make our individual efforts serve the purposes of our fellowmen.

Lighting for Traffic Safety

L. A. S. WOOD
MEMBER AIEE

Developments in modern traffic lighting provide the electric light and power industry with an opportunity to promote the safety of life and property

THE CRITERION of good street lighting originally was based on the candlepower of the light sources; later the illumination produced determined the acceptability of a system. Now, however, the illuminating engineer is concerned with road-surface brightness and its effect on the visibility of objects themselves. This conception of public lighting has grown out of the application of the "science of seeing" to the solution of the night traffic accident problem and, because it combines lighting and seeing with safety, has come to be known as "traffic safety lighting."

Traffic safety lighting differs from conventional street lighting in respect to the methods of discernment. Conventional street lighting is designed to reproduce *illumination* conditions approaching daylight illumination. On business streets—"white ways"—where commercial interests contribute to the cost of the service, it provides adequate visibility for safety. On thoroughfares and other urban streets where smaller lamps and wider spacings are common, conventional street lighting is inadequate to meet the requirements of modern traffic conditions.

Traffic safety lighting, however, is designed to reproduce *visibility* conditions approaching daylight visibility. These conditions can be provided at reasonable cost by rendering the road surface bright so that objects are seen as outlines (silhouettes), contrasting with the brighter pavement.

Pavement Brightness

The major purpose in the design of traffic safety lighting is to enhance silhouette vision by increasing pavement brightness, and because the burden of avoiding an accident rests mainly upon the automobile driver, it is important that the maximum surface brightness be visible from the driver's seat.

This is accomplished by pendant luminaires with redirecting devices designed to deliver the incident light on the pavement at angles which will locate pavement reflections within the normal vision of the automobile driver. Conventional luminaires of the older type deliver the light to the road surface at acute angles and most of the reflections are skyward, rendering the road surface dark when viewed from the driver's seat, as shown in figures 2 and 3.

On light, diffuse pavement, such as dry concrete, there is a definite relation between brightness distribution on the pavement and the distribution of pavement illumination; but when the pavement has some element of specularity, or the surface is wet, the distribution of pavement brightness bears little relation to that of pavement illumination. "Isolux" curves, such as have been used in the past, do not under these conditions present a correct picture of brightness, for pavement brightness varies not only with the distribution of illumination and the reflection factor of the surface, but also with the angle of incidence of the light and the angle from which the surface is viewed (angle of reflection). Uniformity of illumination is not essential to uniformity of surface brightness, which may exist where there is much variation in distribution of illumination.

Seeing, Stopping Distance, and Speed

According to Doctor Luckiesh (*Proceedings* of Institute of Traffic Engineers, 1938, page 57) there are four fundamental factors associated with the visibility of an object:

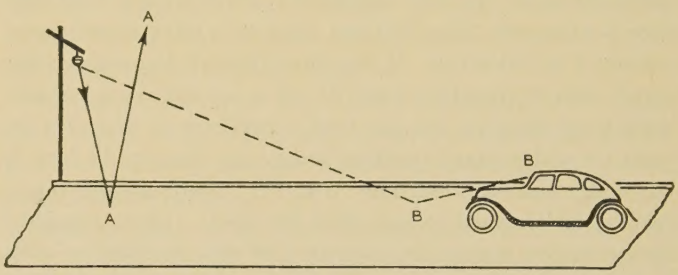

Figure 1. This diagram illustrates the difference between conventional street lighting and traffic safety lighting. Many old types of luminaires in present use direct light as shown by beam A, so that it is reflected skyward and for practical purposes lost. Beam B shows how the light from the luminaire in a modern installation is reflected toward the approaching motorist

size, contrast, brightness, and time. In the lighting of public roads, contrast and time are the important factors in a driver's seeing when his car is approaching a hazard. Together they may be conveniently classified as "visibility distance," the extent of which determines the time (distance) available for stopping the car before a collision results.

On the open road, and on thoroughfares and other urban streets outside business districts, where lighting conditions are inadequate, the driver is dependent on the visibility from automobile headlamps. But headlamp visibility

Based on a paper presented to the AIEE Alabama Section, Florence, Ala., November 18, 1938.

L. A. S. Wood is chief lighting engineer, Westinghouse Electric and Manufacturing Company, Cleveland, Ohio.

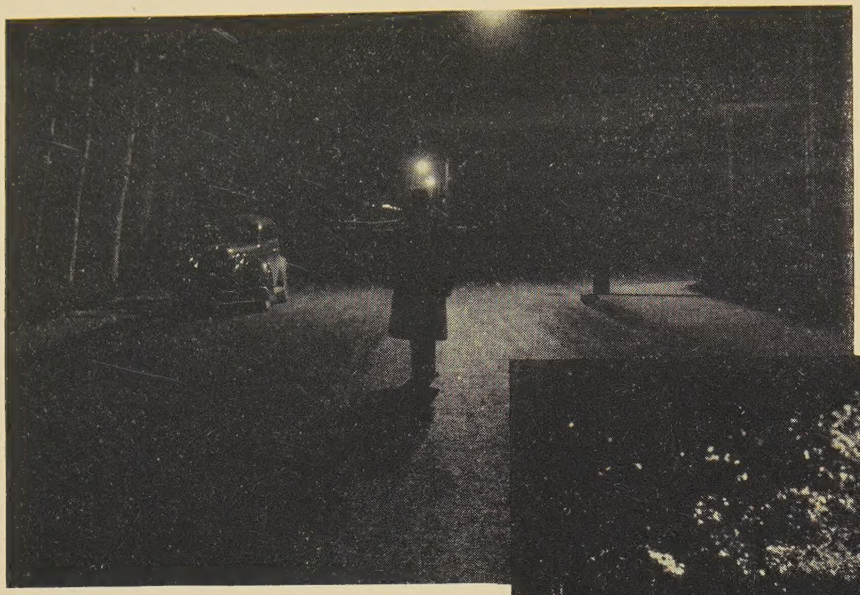

Figure 2 (left). Before relighting, this section of West Newton Street, Greensburg, Pa., was an excellent example of "distributed darkness," in which danger lurked. Reflections of the light from the conventional luminaires were largely skyward, and the road surface appeared black to the motorist

Figure 3 (right). After installation of modern luminaires, the same section of West Newton Street, Greensburg, Pa., presents a "silhouette of safety." Reflections from the road surface are in the direction of the driver, to whom the surface appears bright

distance under the best conditions of a light dry road surface is not more than 200 feet, and on a dark or wet road surface it is much less. Tests show that while a reasonably quick driver (reaction time $^3/_4$ of a second) in a vehicle with good braking (64 per cent) traveling at 20 miles an hour on a dry, hard-surfaced road, can stop in 43 feet, a car under similar conditions, traveling at 60 miles an hour, cannot be stopped in less than 251 feet. These stopping distances are materially increased in wet weather or with brakes in less-than-average condition.

Speed in its relation to stopping distance is a function of the automobile driver and should be governed by the condition of the road surface, the quality of the brakes, or speed regulations. Social experience, however, has proved conclusively the impracticability of controlling speed within the range of automobile headlamp visibility distance (20 miles an hour), and because of legislative limitations on beam candlepower, it is impossible at this time to increase headlamp visibility distance to modern driving speeds. The solution of the night traffic accident problem resolves itself, therefore, into increasing driver visibility distance to modern driving speeds by traffic safety lighting.

Visibility distance is just as important in daytime as at night. In daytime it depends on the configuration of the road and can be increased by the elimination of curves, hills, trees, and other obstructions that limit vision. At night the roadway is shrouded in a veil of darkness which can be mitigated only by artificial illumination commensurate with modern driving speeds.

The American Road Builders Association estimates that a visibility distance of 1,800 feet is necessary for safe driving at modern speeds in the daytime. Traffic safety lighting provides a similar visibility distance at night on straight roads.

Where Accidents Occur

The quality of street-lighting service throughout an entire city is often appraised by the effectiveness of illumination on brilliantly lighted business streets, and the inadequate street-lighting conditions prevalent in other parts of the city are overlooked.

Yet it is on thoroughfares and streets outside of the "white way" areas that most accidents occur. A survey of 47 American cities with a total population of 19,000,000, conducted under the auspices of the National Bureau of Casualty and Surety Underwriters, shows that main traffic thoroughfares are the most dangerous city streets. Representing barely 10 per cent of total street mileage, they accounted for 77 per cent of all accidents and 41 per cent of the fatal accidents, 69 per cent of which occurred at night.

Most of the so-called lighting on these streets was designed in the "horse and buggy" days. It was satisfactory for the traffic conditions of that era, but is inadequate to meet the requirements of modern road transportation with its rapidly increasing density and high speeds.

Lacking the commercial appeal of business districts and

financed out of limited municipal street-lighting budgets, the lighting on streets and thoroughfares outside "white way" areas has been sadly neglected. Safety engineers, however, are beginning to realize that traffic safety programs are partially nullified at night without provision for adequate visibility. Traffic safety lighting is now accepted as an essential feature in safety engineering.

New Luminaires

In the production of pavement brightness for the benefit of the automobile driver, luminaire design, lamp placement, spacing, and mounting height are interwoven and mutually dependent. This has led to the development of a new type of luminaire, to be used at a ratio of spacing to mounting height determined by its light-distribution characteristics.

The modern luminaire consists of an inverted parabolic reflector to which is attached a "deformed" pear-shaped globe. The light source, located within the reflector, is completely shielded from the eye of the observer, thus greatly reducing glare. This luminaire produces a symmetrical beam pattern on the pavement surface, and its distribution characteristics are such that it should be used at a maximum spacing of three times the mounting height.

For wider spacing, asymmetric distribution is provided by the addition of supplementary reflectors within the globe on the side opposite the traveled roadway. These supplementary reflectors shield residences from undesirable light emission and spread the beam pattern up and down the street. Thus equipped, the luminaire may be used at a spacing of five times the mounting height.

For still wider spacing, lateral distribution is obtained by the substitution of a single-piece refractor for the globe. This luminaire is suitable for use at a maximum spacing of eight times the mounting height, and a minimum mounting height of 25 feet is recommended.

In modern street-lighting practice, the luminaire is designed for specific applications to be spaced and mounted according to its light distribution. Therefore, the design of modern street-lighting systems is relatively simple. First determine the type of street to be illuminated. Ascertain whether it is a business street, a major or minor traffic thoroughfare, a residence street, or a highway. Then select the luminaire recommended for the particular application and use it at the ratio of spacing to mounting height for which it is designed.

For business streets, the symmetric-reflector type of luminaire is recommended, at a spacing of three times the mounting height. If wider spacings are desired, the asymmetric-reflector type at a spacing of five times the mounting height may be used to advantage.

For major traffic thoroughfares, on which there is a minimum of 1,500 vehicles per hour in both directions, and a combination of surface detail and silhouette vision is desirable, the asymmetric-reflector type is recommended at a spacing of five times the mounting height. In this application, 20 feet is the recommended minimum mounting height. Higher mounting is preferable.

For minor traffic thoroughfares on which there is a minimum of 800 to 1,000 vehicles per hour in both directions, the refractor type is recommended at a minimum mounting height of 25 feet and a spacing of six times the mounting height.

For residence streets where for reasons of economy wider spacings are desirable, the refractor type at a minimum mounting height of 25 feet is recommended, with a maximum spacing of 200 feet.

Used at the ratios of spacing to mounting height for which they are designed, modern street luminaires will provide uniform surface brightness against which objects are clearly seen as silhouettes.

Traffic Safety Lighting Saves Lives

Of all important municipal operating expenditures, street lighting has advanced less since 1911 than any other. During the period 1911 to 1931, street-lighting costs rose only 60 per cent, while traffic increased 5,000 per cent. In the past three years, however, many cities have adopted traffic safety lighting and have found that when adequate night visibility is provided, the night and day fatality experience on streets equipped with traffic safety lighting is practically the same, although before fatal accidents were much more numerous at night than in the daytime.

Detroit, Mich., for example, now has in operation approximately 300 miles of traffic safety lighting on many of its main thoroughfares. According to L. J. Schrenk, general superintendent of Detroit's lighting commission, the ratio of night to day fatalities on these roads has been reduced from 7 to 1 before relighting, to 1.57 to 1 under adequate night visibility conditions.

Further analysis of Detroit's accident records shows that traffic safety lighting decreases many of the traffic fatalities which in the past have been attributed to driver or pedestrian faults.

Summarizing, in the 15 classifications where according to the police records, "the driver was at fault," there were,

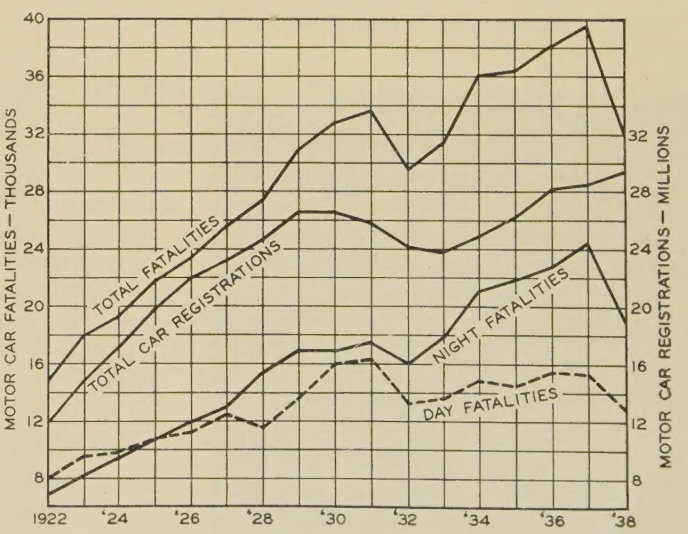

Figure 4. Comparison of motor-vehicle fatalities with total car registrations during the period 1922–38

in the three years prior to relighting, 54 night and 6 day fatalities. After traffic safety lighting had been installed on these streets, only 7 night and 2 day fatalities occurred in 18 months.

On ten miles of Hartford, Conn., streets where lighting was improved from 0.18 to 0.43 lumens per square foot, complete records of all accidents involving death, injury, or property damage over $25.00 show a decrease of 46 per cent in night accidents after relighting. On similar streets not relighted, night accidents increased 4.1 per cent in the same period.

A survey in Evanston, Ill., under the direction of the traffic engineer of the National Safety Council, showed that after the installation of a complete new lighting system, night accidents resulting in personal injury or death were reduced 23 per cent. During the same period day accidents rose 30 per cent, because of increased traffic.

James E. Davis, chief of police of Los Angeles, Calif., states that inadequate lighting is the greatest single factor contributing to traffic hazards in city streets. He points to Los Angeles' fatality record for February as striking proof of this statement and predicts that provision of adequate safety lighting, which is being installed as fast as equipment is available, will save 78 lives a year and reduce by more than 15 per cent the Los Angeles automobile death rate.

National Fatality Records

In 1938 the United States experienced its second annual decrease in motor-vehicle fatalities since the turn of the century and its lowest traffic death total since the depression years of 1932 and 1933 (see figure 4). The improvement was due to intensive national safety activity in which many communities competed. Although more than 7,000 lives were saved in 1938 as compared with the peak death figures of 1937, the death total of 32,000 remains far too high. Moreover lacking provision for night visibility, the intensive safety campaigns are more effective in the daytime. Of all fatalities, 59.4 per cent (only 1.7 per cent less than in 1937) occurred at night. Twenty years ago, night fatalities represented barely 30 per cent of total.

Successful Programs Adopted

Many power companies already have adopted progressive public lighting programs, with success which demonstrates the feasibility of such activity. A notable and convincing example is the modernization program adopted by the West Penn Power Company. This program was introduced in 27 communities in 1938. Approximately 1,500 new luminaires were installed during the year and 24 contracts were renewed in advance of expiration, in addition to three that expired during the year.

The first city on the program was Greensburg, Pa., a community of 16,000 located where many national highways converge. A complete report covering every street and byway in the city, with recommendations for traffic safety lighting, was prepared along with promotion folders emphasizing the value of adequate visibility. The recommendations may be summarized:

	Present System	Proposed System	Proposed Increase
Total candlepower	231,250	384,250	153,000
Net annual cost	$20,079.50	$32,263.85	$12,184.29

This "progressive planned street-lighting program" covering a five-year plan was adopted in its entirety by the city council on November 4, 1937. On November 22, the council decided to put the entire program into effect immediately instead of spreading the improvements over a five-year period.

The plan was completed in five months and dedicated in the fall of 1938. The new system, which has proved to be all that was expected, increases the annual cost of street lighting in Greensburg from $1.30 to $1.95 per capita and the citizens are delighted at the night visibility conditions purchased by the annual outlay under their five-year contract (see figures 5 and 6).

The promotion of traffic safety lighting is a humanitarian program. The electric light and power industry is in a key position to assume leadership in night traffic safety and to perform a valuable public service toward the reduction of night accidents.

Figure 5 (left) shows Penn Avenue, Greensburg, Pa., before relighting. Conventional luminaires were used, equipped wtih 6,000-lumen lamps; spacing was 100 feet opposite, mounting height 18 feet. The same corner, after relighting, is shown in figure 6 (right). The new luminaires are reflector type, with 5,000-lumen lamps; spacing is 100 feet opposite, mounting height 22 feet

The Engineer as Conservator

C. W. KELLOGG
MEMBER AIEE

Engineers, as conservators of capital, have a special duty to sound the alarm against the dangers underlying a continuation of wasteful governmental spending, says this prominent engineer.

"ETERNAL vigilance is the price of liberty." From this proposition, which has attained practically the standing of an axiom, follow several corollaries: First, eternal vigilance is the price of all worth-while things. Anything that does not require constant care and attention or effort to conserve naturally is considered of little value because we come to take it for granted. As the proverb says: "Blessings brighten as they take their flight." A second corollary is that at times we should pause to consider the bases of our general situation in order to see what freedom, or other fundamental factor of our lives or businesses, is in danger of being lost through lack of appreciation of its value and importance, so that we may take thought on how to conserve it. In the third place, in our democratic country the people themselves must look out for their own fundamental interests, for nobody else will do it for them.

On the basis of the broad principles just outlined, I should like to discuss briefly a basic problem of our country which I believe should appeal especially to engineers. I refer to the present fiscal policy of our National Government.

The problem is clearly portrayed by a wealth of public statistics. It may be summarized as follows: We are now nearing the end of the ninth consecutive fiscal year in which our National Government has spent more than it took in and the tenth year, which begins July 1, 1939, will show a continued heavy deficit. During the nine-year period now ending the *increase* in national debt resulting from deficits is nearly 25 billion dollars and the total national debt by June 30, 1940, will probably approximate 44 billion dollars. The major part of this debt has been forced upon the banks of the country at abnormally low rates of interest, such low rates being produced largely by the very excess of unneeded credit which the loans themselves create. This has reacted on the return on capital in all lines, thus forcing the permanent investors, like the life insurance companies, savings banks, and educational institutions, to see the return upon which their beneficiaries depend almost cut in two. To date, at least, we have hardly begun any effective moves to stop the destructive process of borrowing money to pay current expenses. I believe, however, that serious thought on this vital matter is gradually gaining momentum.

The immediate threat of this ruinous fiscal policy is definitely to the thrifty class, although all will inevitably be caught by it in the end. The special interest of the engineer in this whole matter is that the very nature of his professional work has been to conserve capital, to see that it is expended on physical property in the most economical and effective manner. Without the skill and experience of the engineer, serious waste of capital would continually recur; and the great economic value of the engineer to the community (in the conservation of capital by the avoidance of waste in its use) is vastly greater in amount than the cost of his services in its conservation.

Capital and the Engineer's Job

Not only does the engineer thus save capital for the community, but his own welfare and activity depend upon the constant production of new capital to be applied to useful development. A policy that cuts down the return on capital inevitably discourages the accumulation of capital, for the only incentive to the thrifty man to save, and to conserve what he saves, is the hope of a reward for his self-denial and forethought in the shape of a fair return. Wiping out or cutting down the wages of capital, therefore, directly affects the engineer's job.

The fact that the Federal deficits of recent years have been built up in the face of taxation as heavy as at any time in our national history is a strong indication that the deficits are principally due to wasteful spending. When taxation is already so heavy as to be a serious deterrent to business expansion, it is manifestly inexcusable that even these excessive tax levies should be hardly more than half enough to pay for the yearly outlay. Such folly leads to financial chaos with a nation just as surely as with an individual; the only difference is that in the former case it takes longer to accomplish, because of the huge resources that can be drawn on, especially in a naturally rich country like the United States. The engineer knows from his regular experience that he must "cut his cloth" to suit his client's purse and that a given proposed development, no matter how otherwise desirable, cannot be carried out unless adequate funds can be made available.

It seems to me that in the ignoring of this point has been the essence of our national financial folly. Hardly an individual can go through life without encountering occasional periods of financial stress, when, because of illness or financial reverses or some special requirement,

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expenditures for a time must exceed income. Such a period calls for temporary loans, or the sale of assets, or other special arrangements; furthermore, it calls for the most careful scrutiny of all expenditures, so as to make sure that precious assets are not needlessly wasted. For a prudent individual, such a time of stress would hardly be made the occasion for building an unneeded wing to his house or for branching out needlessly into any new lines of family activity.

Our national economy is but the integral, of which each individual economy is the differential. There is no doubt that the collapse of values and of business activity which followed the debacle of 1929 represented for the nation just the sort of emergency period that most individuals encounter occasionally in an ordinary lifetime. Did our Government meet this situation with the effort (which I think we can agree a prudent individual should exert in similar circumstances) to confine those expenditures made on borrowed money to the absolute necessities of the case? In frankness, I think we must admit that it did not.

Goverment Spending in Individual Terms

Emerson's perhaps most-quoted remark is that one to the effect that every human institution, no matter how great, is but the lengthened shadow of a man. By the same reasoning the most enlightening way to appraise any great institution is to reduce it to one-man proportions.

Suppose you had a neighbor whose average annual income over a nine-year period had been $4,028 and whose average annual expense $3,113, so that he averaged to save during those nine years $915 annually, or an aggregate for the period of $8,235. Based on this admirable showing you would be justified in the opinion that this neighbor had handled his financial affairs in a sound and satisfactory manner and you would be right in assigning to him a high credit rating for his size.

Suppose further that toward the end of this nine-year period your neighbor found his income falling off and yet had substantially greater burdens to bear than before. In the lowest year of the next nine-year period his income was but $2,006. By strenuous effort he succeeded in building back his annual income so that for the second nine years it averaged $3,929; in fact, for the next to the last year of this second period he had worked it up to $6,242. Yet in this second nine-year period he spent an average of $6,411 per annum (more than twice what he had averaged in the previous period), not counting a large nonrecurrent item of $2,000; and in the last year of the second period he spent $9,492. So that although during the first nine-year period he saved $8,235, in the second period he went behind on current account, to the extent of $22,338.

Having in mind the excellent showing he had made in the early period with an average annual income of $4,028, I think you would be justified in wondering why, when his income in the best year of the second period was more than 50 per cent above his former average, he went in the hole even that year $1,384, where before, with the lower average income, he had saved $915. You would be less than human if you did not seriously doubt if he had made anything like the same effort to save in the later period that he had made in the earlier period. I believe your doubt would be so great that you would feel it necessary to revise completely your earlier verdict as to the credit standing to which he was entitled.

If in this suppositious case you call the neighbor "Uncle Sam" and multiply all figures by a million, you will get an approximately accurate picture of our current Federal finances for the two nine-year periods ending, respectively, in the middle of 1930 and of 1939.

If you should think that I have been too general in my claim as to the wastefulness of expenditures during the nine years just ending, let me enumerate a few main items:

1. Increase in expenditure for public works in the last nine years compared with the previous nine years	$ 6,075,000,000
2. Payment of soldiers' bonus nine years before the due date of the certificates covering it	2,000,000,000
3. Relief expenditure waste (since 1933) consisting of the difference between $23 per person per month spent in state and local relief and $65 per month per man spent by WPA. This ratio, applied to the $14,178,000,000 actually spent, shows an excess of	9,161,000,000
4. Simple interest on the foregoing at 2 1/2 per cent per annum	1,346,000,000
These four items are rough "measuring sticks," but they amount to the huge total of	$18,582,000,000

Thus, about three-quarters of the increase in Federal debt during the last nine years can be ascribed to unnecessary extravagance.

Credit Needed for National Defense

Another important element in the plans of a thrifty individual is to save for a rainy day, to avoid a load of debt today in order to conserve borrowing capacity for future periods of particular stress. The "rainy day" that now appears to be fast approaching in the United States is necessary preparation on a big scale for national defense. Could anything show more clearly how we have wasted our resources on unnecessary extravagance than to find ourselves loaded with the present debt of over $40,000,000,000 at a time when we may well need most of that borrowing capacity to carry us through a real pressing requirement of our national safety?

It is amazing, in view of the wealth of historical evidence on the subject, some of very recent origin, to find men high in our Government seriously advocating, as a relatively fixed and permanent policy, the present method of so-called "deficit spending." It can mean only one of two things: either that we are deliberately loading onto our children and grandchildren current costs for which they will get no benefit; or that we propose to see the obligations of the United States Government repudiated on account of future inability to discharge them due

to present profligacy in wasting our resources. Either horn of this dilemma we should recoil from aghast; and yet, if present spending trends continue, one or the other is unavoidable. Meanwhile, even if we are willing to turn our backs in a cowardly manner upon these two eventualities, the fact remains that already the policy has virtually cut in two the return on capital in this country.

Conditions Causing Cheap Money

Perhaps it might seem at first thought that cheap money is a good thing for the country and that cheap capital should reduce the cost of goods or services to the extent that these costs depend on the use of capital. What such superficial reasoning overlooks is that when money is cheap it is so because there is relatively little demand for it and that this relatively small demand arises from fear of the effects of the fiscal policies of the Government. The times of easy money in the United States have never been prosperous times (usually for the reason just stated); conversely, the periods of great prosperity have always been those when capital earned a fair and ample rate of return, such as encouraged the thrifty to save it and the enterprising to employ it. Engineering is the handmaiden of prosperity; it is most useful when most used and that means when the maximum amount of new capital is being laid out and needs expert care to lay it out to the best advantage.

Even the artificially created cheap money of the present era is more apparent than real, for it applies only to borrowed money. The real working money of the enterpriser, which is the basis of all true economic progress, is not cheap, partly because of the fear of the future just mentioned, and partly because, with the present-day heavy taxes, the balance for return on such enterprise money is only too likely to be a red figure.

This whole fiscal policy has been like killing the goose that laid the golden eggs. This particular goose is the average thrifty citizen. With inheritance and surtaxes, the man of great wealth has become a relatively minor source of new investment capital. In aggregate size he never was as large as his individual conspicuousness would seem to indicate. No, the backbone of capital creation in the United States is the aggregate savings of millions of frugal citizens of relatively small individual wealth; and it is this person that is being battered down so that he no longer can contribute as he used to in helping others, because he can barely take care of himself.

The question, therefore, that comes directly to engineers, the natural conservators of the capital of the people, is, what ought we to do about the matter? We owe it to ourselves and to our country to do all in our power to spread the information among the people. One difficulty in discussing Federal finances with the average man is that the figures are so large as to seem to be beyond his grasp. This can be overcome by the unit method I have used. Another hurdle is that Federal finances seem so far away that the direct effect on each individual is not easy for him to visualize. Every man who is supporting and raising a family of children has a lively interest in the burden of debt now being built up for them to carry. Every young man and woman starting out in the world is right now at grips with the load which Government debt imposes; either they must work to pay it off, or they must see the value of their money destroyed if the debts cannot be paid and have to be repudiated. Literally no one can escape a personal effect from continued Government spending in excess of a level of tax earnings that is already up to about the limit that industry can carry.

We can all support actively the publicity on this subject being undertaken by various national and local organizations. The National Economy League, New York, N. Y., has recently published a most timely pamphlet entitled "How to Balance the Federal Budget." The necessity for national economy and retrenchment is already being valiantly pointed out by some leaders in Congress. This body, because of the many varied local interests necessarily represented, is not ideally suited to economy; but every Congressman really desires to represent faithfully the wishes of the people upon whose votes he depends. The members of both houses of Congress should be told how deadly in earnest the people are about their public finances. They cannot know unless they are told. They doubtless hear plenty from those who expect to receive part of the extravagant expenditures; they should hear also from those who have to suffer from those expenditures; they must be made to realize, before it is too late, that if the public debt continues to pile up as it is doing, everyone, both receivers of, and contributors to, public funds, will be engulfed in a common calamity.

Engineers Should Publicize Economy Need

The general purpose of all engineering societies, to which of course the AIEE is no exception, is to further the improvement of the art by the study and discussion of better and more economical ways of accomplishing results of a purely engineering nature. This is natural, due to the essential function of the engineer as the conservator of the people's capital. It is futile, however, to talk of such improvements when the very capital for whose conservation they are intended is being dissipated or destroyed by governmental fiscal policy. It seems to me now, therefore, more important than anything else to stress this imminent underlying danger.

Let us not be discouraged in our efforts by the vast scope of public opinion. We must remember that in any democracy the general opinion is the sum of millions of parts. The tide is already setting in toward an appreciation of the necessity for Government economy. Each of us has friends, neighbors, business associates, through whom the discussion can be widened. Each of us has Congressmen to whom he can write. Each of us, representing that part of the community most expert in the conservation of capital, has, for that reason, the special duty to sound the alarm. May no engineer be found recreant to that duty!

Utilizing Heat From the Sun

C. G. ABBOT

Modern development of aluminum products and vacuum devices makes feasible and economically practical the wholesale production of solar-heat appliances for various purposes, according to an authority on solar radiation who has been experimenting with such appliances for 20 years.

IN LARGE regions lying in the low latitudes desert conditions prevail. Day after day the sun glares down, occasionally dimmed a little by cirrus clouds, or perhaps by a few heaping cumuli. In such regions 80 per cent or even more of the hours of daylight would be useful for furnishing solar heating.

Quantity of Solar Energy

The quantity of energy available from solar radiation under such conditions is immense. As I shall show in what follows, we may count on the possibility of converting 15 per cent of the energy of such solar rays as are intercepted by our devices into mechanical work. Assuming that, to avoid appreciable losses through shading one unit by another and to allow plenty of room for other purposes, only one tenth of the area available is actually covered by heat collectors, and further allowing for night and cloudy weather, still the State of New Mexico could supply from solar radiation over ten trillion horsepower-hours per year of mechanical power. That somewhat exceeds the power possibilities of all coal, oil, and water at present used annually for heat, light, and power combined in the United States.

Intermittance and Storage of Solar Power

Like hydroelectric power, solar power demands no continuing expense except for care and interest on the investment. Unfortunately, however, solar power is subject to the drawback that it ceases during night hours, and when the beam is intercepted by clouds. There are certain uses, such as pumping water for irrigation, for instance, where this intermittance is no serious objection. But for most purposes power must be available at all times. Hence to become a great industrial factor solar power demands the association of storage of energy, either as heat, or in chemical, electrical, or mechanical forms. As efficient production of solar power must nevertheless be the first step, I shall postpone considerations of storage for the present.

Water Distilling and Cooking by Solar Heating

There are other uses for solar heating which do not so seriously involve storage. Among them are the distillation of water and the cooking of food. It is stated that in Bermuda the past year was so deficient in rainfall that fresh water was imported from New York, although the Atlantic Ocean is all around. In parts of some western states the water is too alkaline for drinking or for storage batteries. In Florida the water stinks with hydrogen sulphide in some localities. Under such conditions as these the solar distilling device should be useful. For cooking, though it is not practical in cloudy regions, it is easy to provide heat storage for 24 hours, and with a solar cooking device the ovens may be kept at baking temperatures for weeks and months continuously in the more cloudless parts of our country.

Recent Commercial Products a Boon to Solar Devices

The cheap production of efficient solar-heat devices has awaited the commercial development of aluminum products, now so plentifully used in the industries, and the common use of vacuum devices, which came with the incandescent lamp and radio industries. Formerly inventors relied on glass mirrors which were heavy, costly, and not durable. It is now possible to purchase the so-called "Alcoa" in thin sheets, which readily take the curvature of a suitable cradle form without previous shaping. This material reflects over 80 per cent of solar radiation, and may be used for years without dimming. As the loss of heat in the boiler at the focus of a solar-radiation appliance is the great obstacle to be provided against, the possibility of making cheap glass jackets enclosing high vacua like thermos bottles is the other great improvement which has become practicable in recent times.

Mechanism for Following the Sun

The daily march of the sun through the sky, and its yearly march from north to south, must be considered. If one uses a spherical boiler and a circular mirror he must allow for both of these apparent motions, as Eneas did at the ostrich farm, Pasadena, Calif., about 1905. If, however, one uses a tubular boiler parallel to the axis of the earth, the yearly adjustment is unnecessary and the daily motion can be allowed for merely by rotating the parabolic cylindric ray-concentrating mirror about an axis coincident with that of the boiler tube at the rate of 15 degrees per

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hour. The boiler tube may be firmly fixed, and with the simplicity of the mechanical driving of the mirror, renders this arrangement preferable to all others for most purposes. The mirror may be driven by clockwork, or, if electric facilities are available, still better by a 60-cycle synchronous motor through a worm and wheel.

I have used both types of driving. Our solar cooker on Mount Wilson, having been built long ago, is cumbersome. It has a heavy mirror, 8 feet wide by 12 feet long. I attached to the mirror a grooved wheel 30 inches in diameter coaxial with the lower trunnion of the mirror. A steel wire in the groove of the wheel supported a weight of about 200 pounds, sufficient to rotate the mirror toward the west. Through a second steel wire wound in the groove in the opposite sense, the weight also drove a clockwork. This clockwork train ended in a flyvane. A long hand rotated with the central shaft and once in each revolution was stopped by a displaceable pin. The long hand would make a full rotation in about three minutes. A common alarm clock was provided with a wheel of 12 pins on the back of its hour shaft, and these pins, acting through a lever escapement, displaced the stop-pin once each five minutes. Hence the mirror moved intermittently as governed by the alarm clock, and was never more than one minute from its proper position to focus sun rays upon the heater tube. Still simpler clockwork contrivances may be used to drive smaller mirrors for solar heating devices.

Domestic Water Heaters

Those who have visited Florida or southern California may know of the roof water-heaters which are used considerably for providing hot water for bath and other household purposes. A shallow depression is let into the southern roof exposure, and lined with blackened sheet metal. Therein is supported a blackened grid of pipes like a steam radiator. The boxlike depression is covered tightly with glass windows. Water circulates through the piping, and thence to a reservoir at a higher level within the house. Such a system acts by gravity like the water-heater system of a cook stove. If the reservoir is well insulated from heat losses and the location is relatively cloudless and never freezing, such a system is found to be very useful for furnishing hot water both day and night, without maintenance cost or attention. While on Mount Wilson, several years ago, I bought 200 feet of black garden hose. I coiled 150 feet of it in a flat coil upon a wooden X, and carried it up the ladder to the south side of the cottage roof. The other 50 feet I connected to the water hydrant in the yard and to a spigot in the bathtub. By this simple arrangement we could draw five gallons of very hot water each half-hour on every sunny day.

Solar Cookers

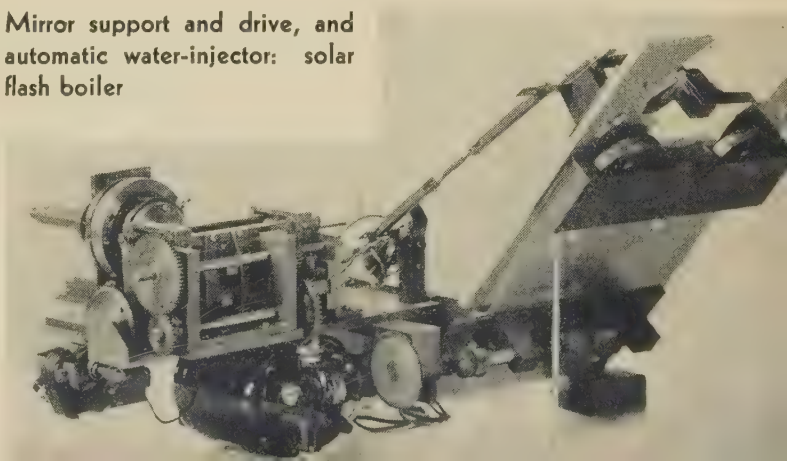
When we attempt cooking by sun heating we require temperatures far above the boiling point of water. Hence some other liquid of a much higher boiling point is desirable as a heat conveyor, otherwise high pressures and evaporation would be encountered. In our cooker on Mount Wilson I used engine cylinder oil within a blackened metal tube in the focus of the mirror. About 60 gallons of the oil were employed in the system, so that there was a large capacity for heat, and cooking could be done by night as well as by day. However, it required about two days of sun to get the system heated initially, because near-by trees limited the sunshine to seven hours per day.

In recent installations I have preferred to use "Arochlor," a nearly black liquid product of the Monsanto Chemical Company. I have made this liquid almost completely absorptive of sun rays by adding a small amount of lampblack in suspension therein. While engine cylinder oil chars somewhat and evaporates considerably at 210 degrees centigrade, "Arochlor" does not boil below 350 degrees centigrade, and evaporates scarcely at all at lower temperatures. This liquid, being highly absorptive, may be used directly in the vacuum-jacketed glass focus tube. Circulation may be provided by bringing back from the oven sheath a small metal or glass tube within the focus tube almost to its lower end. Such a focus tube passes freely through the hollow trunnion at the upper end of the mirror, and is sealed by a well-designed stuffing box to the metal sheath which encloses the oven. According to whether one wishes for a quickly heating oven, or for one to remain hot through temporary cloudiness and the night hours, the oven sheath contains little or much of the liquid. This part of the system may be surrounded by a thick layer of glass wool for insulation, leaving, of course, means for reaching the oven door.

In another embodiment of the cooking device, I have sealed the glass vacuum-jacketed focus tube to a vertical cylindrical glass jar which contains the liquid. Within the liquid is an inner glass jar used as the oven. The food to be cooked is brought into the oven from above. In this embodiment the outer of the two glass cylinders may be itself surrounded by evacuated space. This makes a very beautiful, highly efficient, and quickly heated oven of small capacity. For a large installation it is better not to use the liquid directly as the absorbing medium, but to contain it in a blackened copper tube, itself surrounded by a vacuum jacket of glass. This arrangement lends itself to a more robust connection of the heater tube to the oven jacket. Liquid may then be supplied to give a large capacity for heat and to heat a plurality of ovens.

The following figures will indicate approximately the size of an outfit for solar cooking. In clear sky conditions one may depend on from 1.2 to 1.4 calories per square centimeter per minute of energy in the solar beam. Using the lower of these figures we have still to encounter the

Mirror support and drive, and automatic water-injector: solar flash boiler



following efficiencies: mirror reflection 82 per cent; vacuum jacket transmission, if direct to liquid, about 89 per cent; if through a blackened metal tube to liquid, about 80 per cent. Hence there remain about 0.79 to 0.87 calories per square centimeter per minute. The maximum temperature which a mirror will maintain in an oven depends on the rate of loss of heat. The time required to approach that temperature depends on the capacity of the oven and its surroundings for heat. These variables cannot, of course, be predicted without specifications. But it may safely be said that with good design a mirror, with a surface of 4 by 8 feet will keep two ovens of ordinary size hot enough to bake biscuits well, by night as well as by day, in any fairly cloudless regions in the temperate zones.

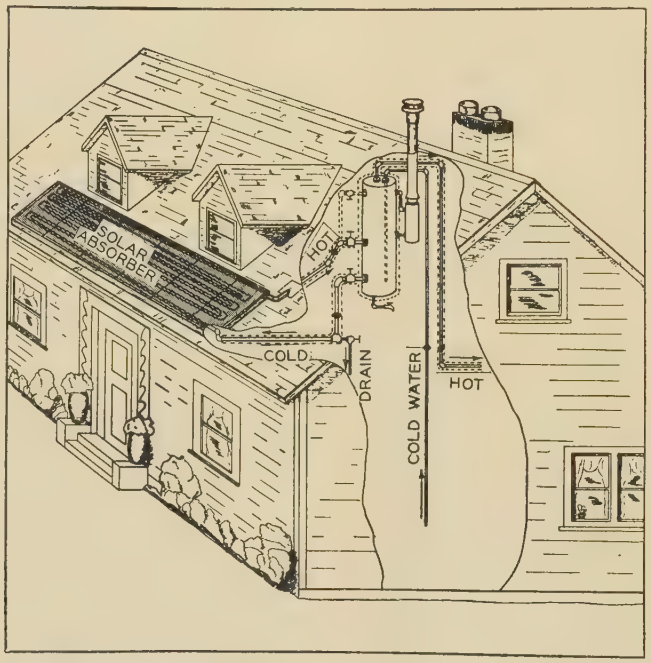
I have constructed a toy cooker with a mirror surface of 15 by 20 inches to warm an oven 3 1/4 inches square, 2 1/2 inches high, and insulated by glass wool 3 inches in thickness. It requires about an hour to heat the oven to about 130 degrees centigrade above surrounding temperatures, and the oven bakes cakes 3 inches square very nicely in a half hour.

Solar Water Distilling

Distillation of water may be very efficiently done with solar heating. The arrangement of the mirror is similar to that just described for cooking purposes. In this case, however, the elongated vacuum jacket, like a thermos tube except that it is not silvered within, is supported in the focus of the mirror with its open end at the bottom, and its closed end extending a foot or more above the top of the mirror, which rotates on rollers bearing the hollow trunnions of the mirror. In the case of the cooker, and also of the power flash boiler, soon to be described, the absorber of rays is made as small in diameter as possible in order to reduce heat losses, so that the temperature may run high. In the solar water distiller, however, the temperature cannot exceed the boiling point of water. With a vacuum jacket surrounding the focus tube, heat losses at that temperature are small per unit area. Hence the focus tube is made much larger in diameter in order to provide freer escape for steam. This requires a larger vacuum jacket than is needed in the devices for cooking and for power.

The water to be distilled is poured into a vessel supported behind the mirror and nearly at the level of the upper end of the mirror. A long snout runs from the bottom of the water vessel down behind and parallel to the mirror, and, bending at right angles, comes up to join the focus tube of copper, which is blackened outside to absorb solar rays. Thus the water flows by gravity from the vessel to an equal height within the focus tube. Within this snout and focus tube is a smaller tube for steam. It extends from above the level of the water in the vessel to above the level of the mirror in the focus tube. It is open to the atmosphere above the vessel, and open to steam above the water in the focus tube. A branch leaves the steam tube at its lowest point, and passes sealed through the wall of the snout, so that distilled water may drop from the steam tube into a receptacle underneath.

Only one difficulty is encountered with this device. The steam must be permitted to escape through an orifice so protected that the surging, boiling water within the focus tube does not ever reach that orifice to mingle with the condensed steam. This is accomplished by a series of umbrella diaphragms along the upper part of the steam tube, and by using a diminished orifice well shielded by a cap.



This diagram shows location of the parts of an automatic water heater using a solar absorber and single storage tank

The efficiency of the device is very high. The steam being condensed by flowing through the entering water, that water reaches the lower end of the boiler tube at almost boiling temperature. Thus it is only the latent heat of steam that must be provided by solar radiation, and not the heat required to raise water to boiling. In experiments made in Florida in March 1938, the stinking water of Arcadia was distilled to perfect purity and odorlessness. Distillation commenced within five minutes after the sun came out of a cloud. A mirror of 11 square feet of surface distilled between two and three gallons of water, entirely automatically in one cloudless day.

The Flash Solar Boiler for Power

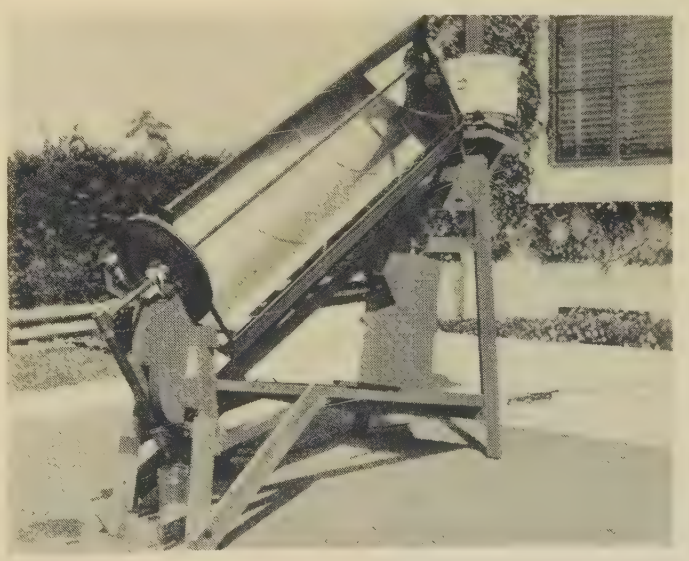
Since cumulus clouds are apt to obscure the sun occasionally in regions suited to solar power production, the flash boiler, rather than the boiler of large heat capacity, is indicated. For if it takes an hour or more to raise the desired steam pressure, many days will be wasted when the sky about the sun is clear one-half of the time. Accordingly my efforts in recent months have been directed toward the development of the automatic flash-boiler

solar engine. That is an engine of a single tube boiler protected from heat losses by an elongated glass vacuum jacket and fed by a current of water automatically graduated in flow by the temperature of the boiler. The device is intended to raise full steam pressure within five minutes after solar exposure. Should the sun enter a cloud the water supply is immediately cut off. Should the steam pressure rise above the desired maximum the water supply is increased. Thus the boiler is fully automatic, and takes advantage of all the clear sky which comes between clouds.

It would be convenient if it were practicable to have the glass vacuum jacket open at both ends so that water could flow in at the bottom and go out as steam at the top. But the unequal linear expansion of the inner and outer tubes of the jacket is difficult to allow for in a permanent sealage. Accordingly I have preferred to make the vacuum jacket surrounding the boiler tube like an elongated thermos bottle with open end up. This requires the water tube entering at the top to pass through the steam to the lower end of the boiler. I introduce two tubes sealed upon the water tube within the boiler, which are called, respectively, the spreader tube and the vacuum-jacket tube. The spreader tube encloses the water tube in the lower two-thirds of the length of the boiler tube, and forces the water to circulate in a thin layer against the inner wall of the boiler tube, so as to be most favorably situated to burst into steam. The vacuum-jacket tube is sealed upon the water tube in the upper one-third of the length of the boiler tube, so as to reduce the tendency of the entering water to cool the superheated steam in the upper part of the boiler tube.

Automatic regulation of the water supply is accomplished as follows: A pump is provided whose stroke is continuously adjustable between the limits zero and the greatest required. The essence of this regulation consists of an eccentric pin forming part of a shaft driven by the same small synchronous motor that rotates the mirror. One end of the pin is coaxial with the shaft bearings, but the other end revolves in a small orbit. The shaft carrying the pin is mounted in a carriage, displaceable longitudinally, so that according to its longitudinal position the pin gives more or less throw to the pitman that works the pump.

To govern the position of the carriage, motion is imparted by a screw driven by a tiny d-c motor operated by dry cells. The operation of this motor forward or backward is governed by a suitable multiple contact switch. The switch is operated by a lever system worked by the differential expansion between the boiler tube and an invar tape attached to the lower end of the boiler tube. Hence the temperature of the boiler, which is the index of the prevailing steam pressure, governs the position of the carriage. Mounted upon this carriage is the uniformly rotating eccentric pin which in turn governs the stroke of the pump that forces water into the boiler.



This device for distilling water by solar heating was used by the author in Florida in 1938

Efficiency of Solar Flash Boiler

Regarding the efficiency of conversion of solar energy into mechanical power by the flash boiler, the following computations are pertinent:

A. Efficiency of the boiler, assumed temperature 190 degrees centigrade:

Mirror reflection	.82	per cent
Transmission by vacuum jacket	.85	per cent
Absorption by boiler tube	.95	per cent
Loss of heat through the jacket	.10	per cent
Boiler efficiency $0.82 \times 0.85 \times 0.95 \times 0.90 =$	.60	per cent

B. Thermodynamic factor for perfect engine:

Assumed temperature of condenser ..... 30 degrees centigrade

Efficiency factor $\frac{190^\circ - 30^\circ}{190^\circ + 273^\circ}$ ..... 34.5 per cent

C. Assumed mechanical efficiency of engine ..... 75 per cent

D. Final Result. Efficiency of conversion of solar to mechanical energy:

Factor $= 0.60 \times 0.345 \times 0.75 =$ ..... 15.5 per cent

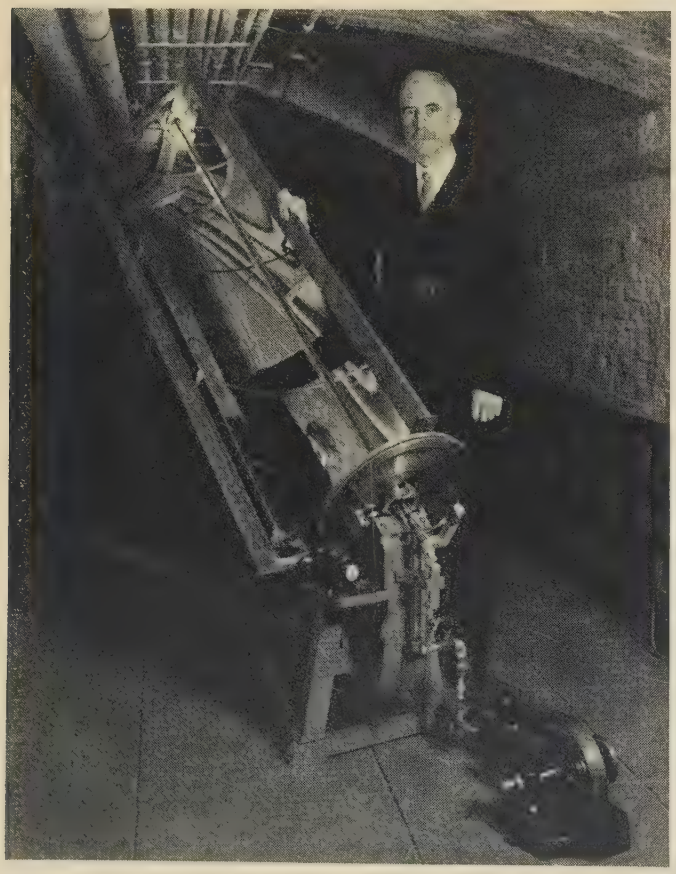
In the experiments of most earlier inventors, the protection of the boiler tube by a vacuum jacket was not practicable; the cheap but accurate construction of the mirror to give high reflection with permanency was not feasible; and the simplest arrangement to follow the sun was not generally used. Consequently the cost was up and the efficiency was down. Hence these earlier devices were quite unable to compete with power from coal or water under most conditions. With the high efficiency and great simplicity of the present flash-boiler scheme, I compute that power can be had from the sun at not exceeding 0.5 cent per horsepower-hour, and still give a good return on the investment.

I wish, however, to refer to one of the earlier inventions in which efficiency was sacrificed for cheapness. It was that of Willsie and Boyle, who installed a solar power plant at Needles, Ariz., about 1910. Their scheme comprised a large shallow black-bottom pond wherein the water attained temperatures considerably below the boiling point. This heat they used to drive a

sulphur-dioxide engine, cooled by the evaporation of water. They claimed that their device was able to compete with coal in that locality, although both its boiler efficiency and its thermodynamic efficiency were low. It appears not to have come into much commercial use, however.

Storage of Solar Heat or Power

I will now consider briefly some suggestions relating to the storage of heat or of power from the sun. As everyone knows, heat is prone to dissipate itself. There are no insulators against heat conduction comparable in efficiency to those which prevent the flow of electricity. My friend, Dr. Cottrell, however, has proposed a scheme which may be worth a trial. He suggests a silo-shaped, cement-lined pit in the ground, filled nearly to the top with dry coarse sand, and roofed over. Above the sand lies a layer of perhaps ten feet of glass wool, such as is used for roof insulation. A pipe leading from the solar heater to the center of the upper surface of the sand has an appropriate network of branch pipes covering the surface. A similar network at the bottom of the pile leads to an outlet pipe, and thence back to the heater. An automatic pump, which runs only while the focus tube is hot, draws hot air through the solar heater into the top of the sand. Owing to the notoriously bad conductivity of dry sand, and the high degree of protection from upward convection and conduction offered by the thick layer of glass wool, the sand pile receives the heat, and keeps it in a horizontal layer. The heated layer gradually works down, until, if the storage operation is continued very long, the whole sand pile reaches a temperature nearly as high as the air in the focus tube itself. With a sand silo of sufficient capacity, Dr. Cottrell thinks the efficiency would be so high that when the heat was drawn away, perhaps months later, by reversing the circulation of air, the air would come away from the top of the sand very nearly as hot as it formerly entered. No one has tried this interesting scheme, but it would be interesting to do so. Should it succeed, it might show the way to use the heat of summer to warm one's house in winter.



Doctor Abbot and his automatic solar flash boiler

Electric storage batteries are so well known that it is unnecessary to point out that solar power may be conserved thereby for night use. It is the cost which handicaps this proposal.

Chemical storage might be done by electrolyzing water, and saving the hydrogen to be burned in air with boilers to generate steam. This involves the problem of successful use of hydrogen as a steaming fuel.

Mechanical storage could be accomplished by pumping water to a high-level reservoir, to be used in a hydroelectric plant later. This also looks costly, and difficult except in hilly country.

Possibly best of all would be heat storage within a pressure tank filled with water and surrounded by a thick envelope of glass wool. The water, heated far above the boiling point, would supply stream for night or cloudy hours.

Commercial Use and Cost of Solar Heating

It is probable that so long as coal is cheap and abundant there will be no extensive use of solar power. However, small installations, in two- to five-horsepower units, may become profitable under favorable conditions. Solar heat has already been used successfully for refrigeration, and possibly might be combined with a heating system for conditioning the air in ranch buildings in cloudless regions. The classic use of solar power is of course for irrigation, and here, as remarked above, the problem of storage is not important. It is conceivable that great reservoirs might be pumped full of water by solar power in dry years to irrigate land when rains fail.

As remarked above, both solar cooking and solar distilling of nonpotable water are practical and efficient propositions, which are likely to be in common use before very long if the necessary outfits can be produced at attractive prices. The cost of solar devices, as of all other products, depends greatly on the volume of sales. As compared with automobiles, however, these devices are extremely simple. Though the cost of producing them singly might be prohibitive, by thousands I do not think it would. In illustration I may say that there is a skilled glass and electrical technician at the Smithsonian Institution who could make, I believe, an excellent Mazda incandescent lamp. I suppose it would cost $25.00. But such is the efficiency of wholesale production that one buys such lamps at the grocery store for 15 or 20 cents apiece. I feel convinced that if some of the solar devices I have described were in wholesale production they could be sold at such low prices as to reach a wide demand.

Terminal Voltage Versus Field Current

Calculation of Curves for Various Overexcited Power Factors

SHERWIN H. WRIGHT
MEMBER AIEE

HAVING the no-load and zero-power-factor (overexcited) saturation curves (figure 1) of a synchronous machine and wanting to construct curves of terminal voltage versus field current for various operating power factors, most engineers will take in hand a bow compass and an engineer's scale and proceed by means of a graphical method to compute various points through which a curve can be plotted. What is believed to be a much simpler method of determining these curves is the one utilizing the curves in figure 2. The procedure is: (1) For any chosen field current read the voltages on the zero-power-factor curve and the no-load saturation curve and compute their ratio; (2) enter figure 2 with this ratio and read the corresponding ratio of terminal voltage to no load voltage; (3) obtain terminal voltage by multiplying the no-load voltage by the quantity read from figure 2.

To illustrate the use of the curves in figure 2, consider the synchronous generator whose no-load and zero-power-factor saturation curves are given in figure 1, and suppose

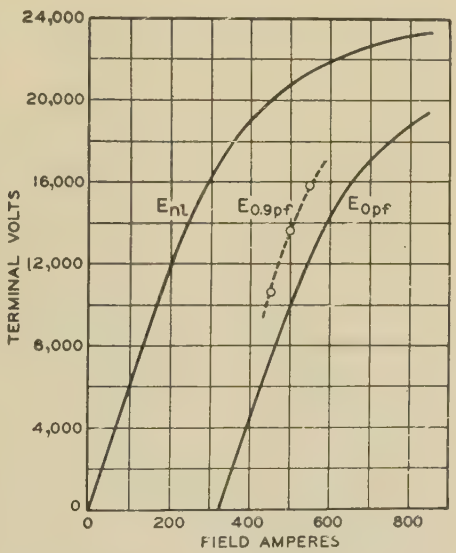


Figure 1. Typical no-load and zero-power-factor saturation curves

E_{nl}—no load

E_{opf}—zero power factor, full load

$E_{0.9pf}$—0.9 power factor, full-load kilovolt-amperes (calculated)

it is desired to plot the curve of terminal voltage versus field current for 0.9 lagging power factor. To obtain one point suppose we choose a field current of 500 amperes. The zero-power-factor voltage, E_{opf} = 10,000 volts, the no-load voltage E_{nl} = 20,800 volts, and the ratio is 0.480. From the 0.9-power-factor curve in figure 2 we read that the ratio of terminal voltage to no-load voltage E_t/E_{nl} = 0.655, and hence terminal voltage E_t = 0.655, E_{nl} = 0.655 (20,800) = 13,700 volts; this then is the terminal voltage for a field current of 500 amperes and 0.9 power factor lagging at full-load kilovolt-amperes. A second point similarly computed for 450 field amperes is 10,700 volts and a third point at 550 field amperes is 15,800 volts, all for 0.9 power factor. A check of these particular values, as well as experience with this method, indicates that in general the accuracy of the results is quite satisfactory and is better than that obtained by the graphical method.

What is perhaps the most commonly used method of solving for terminal voltage (or solving for load field current as it is sometimes expressed) is by means of what is aptly called the "adjusted synchronous reactance" method which is empirical (see AIEE Test Code for Synchronous Machines, paragraph 145, now in report form); in this it is considered that for a given magnitude of armature current and any one value of field current, the synchronous reactance drop is a constant equal to the vertical intercept between the no-load and zero-power-factor saturation curves. While other empirical methods often are employed (see Test Code for Synchronous Machines, paragraph 150, or the new Standards *C*-50 of the American Standards Association) the adjusted synchronous reactance method will probably continue to be used widely. The curves in figure 2 afford a simplified means of applying this "adjusted synchronous reactance" method, and they make a bow compass and scale unnecessary; if a slide rule

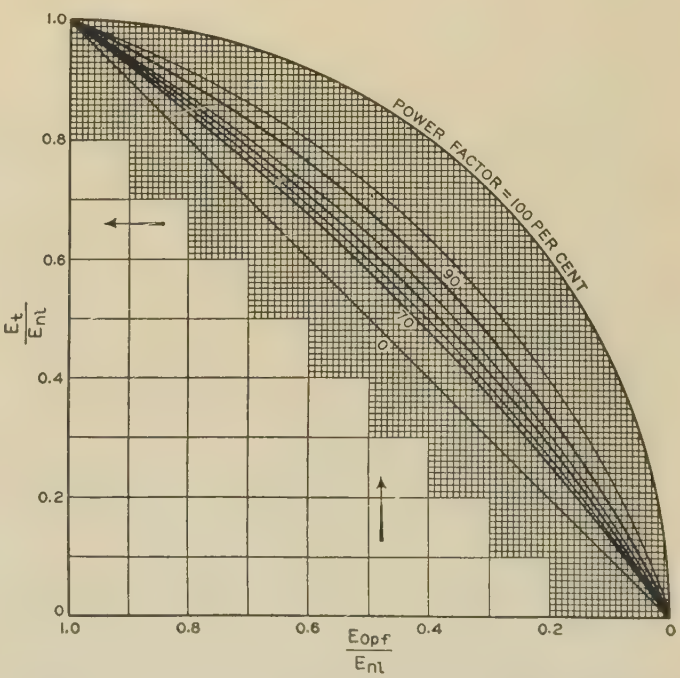


Figure 2. Chart for determination of full-load saturation curves at various power factors by "adjusted synchronous reactance" method

SHERWIN H. WRIGHT is central station engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

is used in conjunction with these curves, the solution is simpler, of engineering accuracy, and usually more accurate than by means of the graphical construction involving a bow compass.

The manner in which the curves were developed may be of interest. In figure 3 the known quantities are the power factor, cos θ, the synchronous reactance drop (IX_s), and the internal no-load voltage, E_{nl}. The terminal voltage E_t is sought, and simple trigonometric relations were derived to give E_t as a function of θ, (IX_s), and E_{nl}. For simplification E_t and (IX_s) were expressed as per-unit values of E_{nl} (merely by dividing by E_{nl}). To determine (IX_s) it would be necessary to subtract (1) the voltage on the zero-power-factor curve from (2) the voltage on the no-load saturation curve, but the need of determining (IX_s) was eliminated by making use of the relation $(IX_s)/E_{nl} = (E_{nl} - E_{opf})/E_{nl} = 1 - E_{opf}/E_{nl}$. Merely reversing the horizontal scale so as to read 0 to 1.0 from left to right would make it possible to use (IX_s) as an index for entering the curve. The curves themselves are merely portions of ellipses; for zero power factor the curve is a straight line, and for unity power factor it is a circular arc.

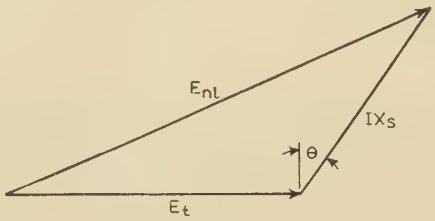


Figure 3. Vector diagram illustrating basis of "adjusted synchronous reactance" method

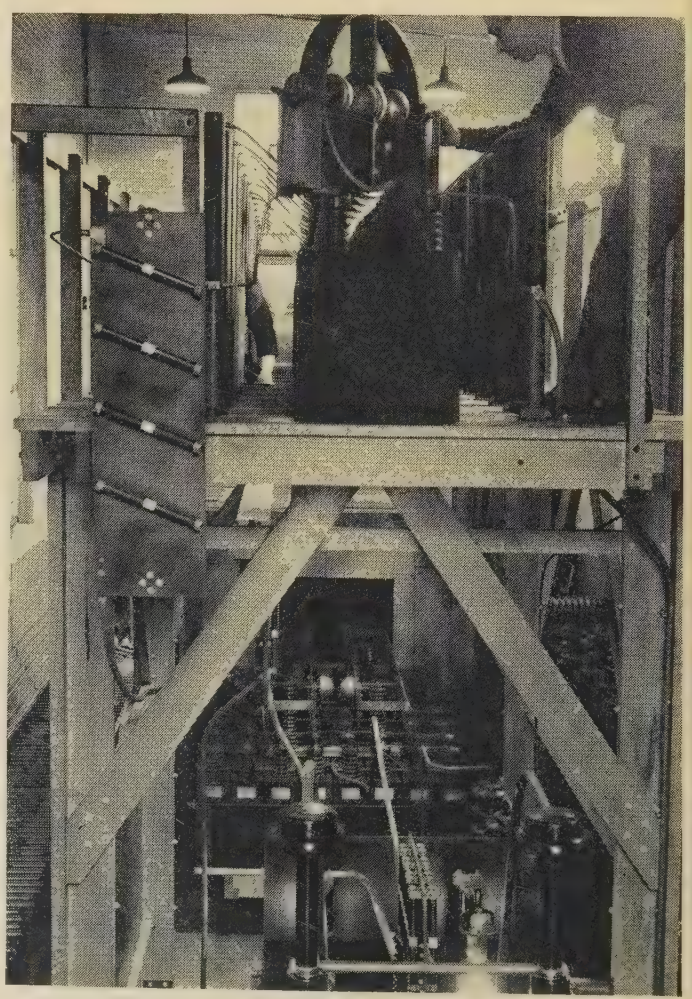
New Forms and Uses of Laboratory-Created Lightning

RECENT demonstrations of artificial lightning showed two significant developments. The first is the use in factory production-line tests of the high-voltage high-current surge generator; the second is the achievement in the laboratory of so-called "hot" lightning, which has all the components of natural lightning. The demonstrations were made by the Westinghouse Electric and Manufacturing Company at Sharon, Pa., where the surge generator is being used to test distribution transformers of the completely self-protected type. The generator which produces the "hot" lightning is being used in the company's research laboratories.

Natural lightning may be said to have three separate components: high voltage lasting a few microseconds, followed by extremely high current continuing somewhat longer, and finally a comparatively low-current discharge which may last as long as a full second. The final element, which causes burning, is the latest to be reproduced.

The first laboratory-made lightning was produced by generators that created a high-voltage low-current discharge lasting a few microseconds and lacking much of the effect caused by the combination of high voltage and high current in natural lightning. In creating a high-voltage high-current generator, the chief problem was to find a means of joining the two elements, so that the current discharge would be released a few microseconds after the voltage discharge. The problem was solved by a device known as a microsecond switch, which in this application is a fiber tube with a small hole through its center, placed in series with the high-voltage generator. The high temperature caused by breakdown of the air in the hole vaporizes a small quantity of fiber, which is expelled violently from the hole. The tube is so mounted that the gas is discharged across the gap holding back the charge of the high-current generator. The electric strength of the gap is sufficiently lowered to permit the current generator to release its charge into the lightning circuit.

An important laboratory tool for testing purposes, the high-voltage high-current surge generator has now become a production tool in the factory. The generator used for this purpose, as shown in the illustration, consists of an upper bank of 15 capacitors that can produce a surge of 1,500,000 volts per microsecond, and a lower bank of 32 that can develop a discharge of 100,000 amperes.



News

Of Institute and Related Activities

New AIEE Officers Elected at Summer and Pacific Coast Convention

AT THE annual meeting of the AIEE, held during the combined summer and Pacific Coast convention of the Institute, just concluded, the committee of tellers presented its report on the election of new officers for the year beginning August 1, 1939. The new officers elected are:

President: F. M. Farmer, vice-president and chief engineer, Electrical Testing Laboratories, New York, N. Y.

Vice-Presidents: C. T. Sinclair, electrical engineer, transmission and distribution, Duquesne Light Company, Pittsburgh, Pa. (Middle Eastern District, number 2); E. E. George, superintendent of system operation, Tennessee Electric Power Company, Chattanooga (Southern District, number 4); A. L. Turner, chief engineer, Northwestern Bell Telephone Company, Omaha, Nebr. (North Central District, number 6); H. W. Hitchcock, chief engineer, Southern California Telephone Company, Los Angeles, Calif. (Pacific District, number 8); J. M. Thomson, chief designing engineer, Ferranti Electric, Ltd., Toronto, Ont., Canada (Canadian District, number 10).

Directors: Mark Eldredge, chief engineer, Memphis Power and Light Company, Memphis, Tenn.; R. E. Hellmund, chief engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.; F. J. Meyer, vice-president in charge of operation, Oklahoma Gas and Electric Company, Oklahoma City.

National Treasurer: W. I. Slichter, professor of electrical engineering and head of department, Columbia University, New York, N. Y.

The board of directors for the administrative year beginning August 1, 1939, will consist of these newly elected officers, together with the following holdover officers: J. C. Parker (retiring president) New York, N. Y.; W. H. Harrison (junior past-president) New York, N. Y.; K. B. McEachron, Pittsfield, Mass.; C. A. Powel, East Pittsburgh, Pa.; R. W. Sorensen, Pasadena, Calif.; C. R. Beardsley, New York, N. Y.; Vannevar Bush, Washington, D. C.; F. H. Lane, Chicago, Ill.; L. R. Mapes, Chicago, Ill.; H. S. Osborne, New York, N. Y.; D. C. Prince, Philadelphia, Pa.; C. L. Dawes, Cambridge, Mass.; A. H. Lovell, Ann Arbor, Mich.; F. C. Bolton, College Station, Tex.; L. R. Gamble, Spokane, Wash. A vice-president from New York City District, number 3, to fill the vacancy left by the election of F. M. Farmer as president, will be elected by the board of directors, as provided in the constitution.

At the general session of the convention June 28, A. S. Bennion, assistant to the president, Utah Power and Light Company, Salt Lake City, gave an address on "Human Relationships." A detailed account of the convention is scheduled for the August issue.

Members of AIEE Los Angeles Section Visit Aqueduct

AS GUESTS of the Metropolitan Water District of the City of Los Angeles, Calif., more than 70 members of the AIEE Los Angeles Section recently inspected the metropolitan aqueduct pumping plants at Parker Dam, 300 miles from Los Angeles. The aqueduct, a $200,000,000 project and one of the largest undertakings of the kind in the world, will have a total capacity of approximately 1,500 cubic feet of water per second. The visitors, who are shown in the illustration, inspected the five pumping stations of the project under the guidance of J. M. Gaylord (A'07, F'35), chief electrical engineer, Metropolitan Water District, and secretary-treasurer of the Los Angeles Section. A group of 400 members and friends of the Los Angeles and San Diego Sections on May 20, 1939, attended a picnic at Palomar Mountain, Calif., where they inspected the dome and mounting of the 200-inch telescope now under construction.

AIEE Board of Directors Meets at Institute Headquarters

THE regular meeting of the board of directors of the AIEE was held at Institute headquarters, New York, N. Y., May 26, 1939.

Present: *President*—John C. Parker, New York, N. Y. *Past-Presidents*—W. H. Harrison, New York, N. Y.; A. M. MacCutcheon, Cleveland, Ohio. *Vice-Presidents*—C. L. Dawes, Cambridge, Mass.; F. M. Farmer, New York, N. Y.; A. H. Lovell, Ann Arbor, Mich.; M. J. McHenry, Toronto, Ont.; I. Melville Stein, Philadelphia, Pa.; Edwin D. Wood, Louisville, Ky. *Directors*—C. R. Beardsley, C. R. Jones, H. S. Osborne, New York, N. Y.; W. B. Kouwenhoven, Baltimore, Md.; K. B. McEachron, Pittsfield, Mass.; C. A. Powel, East Pittsburgh, Pa.; D. C. Prince, Philadelphia, Pa.; R. W. Sorensen, Pasadena, Calif. *National Treasurer*—W. I. Slichter, New York, N. Y. *National Secretary*—H. H. Henline, New York, N. Y.

Minutes of meetings of the board of directors held January 24, 1939, and the executive committee March 6, 1939, were approved.

Executive committee action on applications, under dates of March 21, April 11, and April 25, 1939, was reported, and confirmed by the Board, as follows: 2 applicants transferred to the grade of Fellow; 16 applicants transferred and 31 elected to the grade of Member; 647 applicants elected to the grade of Associate; 219 Students enrolled.

Reports of meetings of the board of examiners held March 16, April 20, and May 18, 1939, were presented and approved. Upon the recommendation of the board of examiners, the following actions were taken: 3 applicants were transferred to the grade of Fellow; 14 applicants were transferred and 13 elected to the grade of Member; 1 applicant was reinstated to the grade of Member; 366 applicants were elected to the grade of Associate; 156 Students were enrolled.

F. V. Magalhaes, Harold Goodwin, Jr., and H. E. Farrer were appointed as representatives of the board of examiners to co-operate with the committee on professional recognition of the Engineers' Council for Professional Development in a study of qualifications for the various grades of membership in engineering societies.

Monthly disbursements were reported by the finance committee, and approved by the board of directors, as follows: $19,390.43 in March, $23,293.15 in April, and $32,258.80 in May.

Amendments to the Institute bylaws were adopted, as indicated: Sections 45, 46, and 47 amended to read as follows:

Sec. 45. Speakers at Section and Branch meetings may present informal talks with or without notes or may present formal papers in full or in abstract from prepared manuscripts. Only the latter are designated as *papers* in these bylaws.
Section officers should endeavor to include a number of formal papers in each year's program, so that, through publication in ELECTRICAL ENGINEERING, a substantial number of high quality Section papers may be made available to the whole membership.

Sec. 46. Section and Branch officers shall be responsible to the Institute for all Section and Branch papers and any recorded discussion of them. Such papers shall not be released for publication in advance of presentation and except as a news item, the name of the Institute shall not be used in connection with their publication unless authorized by the publication committee.
Section and Branch officers should make a reasonable effort to obtain the manuscripts of papers at the time of presentation, and these should be forwarded promptly to the national secretary, with such recommendations as the Section and Branch officers wish to make with reference to publication.

Sec. 47. Except as a news item, the name of the Institute shall not be used in connection with the publication, elsewhere than in ELECTRICAL ENGINEERING, of subject matter presented as an informal talk before a Section or Branch meeting.
Where publication in TRANSACTIONS of Section or Branch papers by non-members of the Institute is involved, approvals shall be obtained in accordance with section 95 of the bylaws.

Section 98 amended to read:

Sec. 98. No paper or address approved by the technical program committee for presentation at a national convention or District meeting, or any written contribution to a discussion thereon, shall be released for publication in advance of presentation except by authority of the board of directors. An informal address or technical paper not approved by the technical program committee for presentation, but included in the program of a District meeting, shall not be released for publication in advance of presentation. The name of the Institute shall not be used in connection with the publication of the subject matter of such an address or paper except in ELECTRICAL ENGINEERING, or in news items elsewhere, unless authorized by the publication committee.

Section 85, fifth paragraph, changed to read as follows:

Each technical committee shall, from time to time, as determined in co-operation with the technical program committee, present at a national meeting of the Institute a report including a brief résumé of the progress of the art in the particular field within the scope of such committee, with the object that these reports may be authoritative sources of information on the history of electrical engineering development. These reports shall be, whenever practicable, published with discussion.

Section 65, the following paragraph added:

At the close of the fiscal year, each committee shall send to the national secretary a report of its activities.

The board confirmed the appointment by the president of the following committee of tellers to canvass, count, and report upon the ballots cast for the 1939 election of Institute officers: E. Curtis Plant, *chairman*, R. W. DeMonte, F. W. Engster, E. T. Farish, W. N. Goodridge, John V. Moses, and E. Volckmann.

A revision of the manual of the technical program committee was approved and its publication authorized. This contains information ordinarily needed by members of the technical program committee, technical committees, and District committees in connection with the handling of national conventions and District meetings of the Institute.

Upon recommendation of the Institute policy committee, the board rescinded the action of the board of directors on January 22, 1934, in ruling "that the subject of depreciation of electrical machinery is considered not within the province of the Institute," and adopted a statement of policy to the effect that meetings of the Institute are open for the presentation of papers on the subject of depreciation, written from an engineering approach, if Institute members desire to submit such papers to the technical program committee for consideration, in accordance with the prescribed procedure for scheduling papers for Institute meetings.

As recommended by the standards committee, it was voted that the AIEE undertake sponsorship of a sectional committee on sphere-gap standards to develop further the standards which have been evolved by a subcommittee of the committee on instruments and measurements, the subcommittee to become a part of the proposed sectional committee. F. T. McNamara was appointed AIEE representative on the sectional committee on radio-electrical co-ordination—C65, to succeed R. G. Warner, resigned.

The establishment of a Student Branch of the Institute at the University of Alberta, Edmonton, Alberta, Canada, was authorized.

Chairman F. M. Farmer presented a report of the committee on planning and co-ordination, which dealt with the assignment to "study the present policy and activities of the Institute and recommend to the board of directors such changes and expansions as it may conclude will best meet the appropriate needs of the membership as a whole and make the Institute more useful to the profession." The following recommendations of the committee were approved by the board:

DISCUSSIONS OF SOCIAL AND ECONOMIC QUESTIONS

1. That the present general policy with respect to this matter be continued.

2. That, in discussing with the Sections their local affairs, it be pointed out that their meetings are informal and that, therefore, there is no requirement for any restriction in the discussions of these subjects.

3. That the forum of the Institute and its publications should be open to comment on public questions involving engineering, particularly large-scale engineering enterprises of government, provided that such comment is limited strictly to engineering and associated facts.

PRESENTATION AND PUBLICATION OF PAPERS

1. That the attention of the program committees for District and even Section meetings be called to the availability of national meeting papers for re-presentation at local meetings. This was a

Future AIEE Meetings

Great Lakes District Meeting
Minneapolis, Minn., September 27–29, 1939

Middle Eastern District Meeting
Scranton, Pa., October 11–13, 1939

Winter Convention
New York, N. Y., January 22–26, 1940

Summer Convention
Swampscott, Mass., June 24–28, 1940

Pacific Coast Convention
Vancouver, B. C., August 27–30, 1940

common practice when the first Sections were organized, and is still the custom in The Institution of Electrical Engineers (British).

2. That special efforts be made to get more papers in the transportation, lighting, marine, industrial, and other special fields, in order to retain as much interest as possible in the Institute as *the* organization of the electrical engineering profession as a whole.

Actions were taken on recommendations of the committee on the following subjects, as indicated:

RESEARCH

1. Postponed to a future meeting consideration of a recommendation for reviewing the proposal to make the committee on research a general committee instead of a technical committee, which has been before the board of directors on two previous occasions.

2. Approved the recommendation that consideration be given to including in the budget for the next appropriation year contributions to projects which the Institute is sponsoring under The Engineering Foundation.

NOMINATIONS PROCEDURE

Approved recommendations that the national secretary urge the members of the national nominating committee to submit to him suggestions for president and for directors; and that the board of directors, when designating its five members of the nominating committee, include at least one who has previously served in that capacity. Another recommendation on this subject was referred to the Institute policy committee.

It was decided that the remainder of the report, dealing with topics on which no recommendations were submitted by the committee, would be scheduled for a subsequent meeting of the board, the president, in the meantime, at his discretion to refer any or all of these topics to either regular or special committees for further study and report.

The board confirmed the application of the Institute, upon the recommendation of the committee on research, to The Engineering Foundation for the continuance next year of support of the work of the welding research committee.

The national secretary submitted a draft of the annual report of the board of directors for the fiscal year ending April 30, 1939, which he had prepared, for approval for presentation at the annual meeting of the Institute to be held in San Francisco, Calif., June 26. The report of the national treasurer for the same period was also presented.

In accordance with article VII, section 37, of the constitution, consideration was given to the appointment of a national secretary for the year beginning August 1, 1939, and National Secretary H. H. Henline was reappointed.

H. B. Gear was reappointed a representative of the Institute on the Washington Award Commission for the two-year term beginning August 1, 1939. The president was authorized to appoint a representative on the board of trustees of the United Engineering Trustees, Inc., for the four-year term beginning in October 1939.

An invitation to be represented at the celebration, November 11–13, 1939, of the semicentennial of the Catholic University of America, was accepted, with the understanding that the appointment of the representative would be made after the new administration is in office.

Other matters were discussed, reference to which may be found in this or future issues of ELECTRICAL ENGINEERING.

Additions to List of Members for Life

Membership for life is granted by the AIEE to members who have either paid annual dues for 35 years, or have reached the age of 70 and have paid dues for 30 years. A list of those who have become members for life during the preceding year is published annually in ELECTRICAL ENGINEERING. The following are the Institute members who have reached member-for-life status since publication of the last previous list in the July 1938 issue.

F. B. Adam
F. J. Adams
E. F. W. Alexanderson
Harry Allcock
C. E. Allen
E. G. Allen
H. R. Allensworth
G. A. Anderegg
A. O. Austin
I. F. Baker
L. W. Bates
W. V. Batson
B. B. Beckett
Sven R. Bergman
N. S. Braden
Graham Bright
H. B. Brooks
A. E. Brown
J. M. Bryant
G. A. Burnham
John Campbell
C. E. Canfield
A. R. Cheyney
B. C. Condit
A. W. Copley
J. B. Cox
W. M. Dann
G. S. Davis
J. M. Donaldson
Lee De Forest
E. A. Ekern
Richard Eyre
F. L. Francisco
W. R. Garton
C. H. Gilbert
W. T. Goddard
R. H. Goodwillie
A. G. Grier
C. E. Hall
W. A. Hall
Dean Harvey
V. Hayden
W. Hemphill
T. Hibbard
W. E. Holland
F. W. Huels
S. R. Inch
L. T. Kaiser
O. F. Kern
C. F. Kettering
C. J. Kiefer
C. W. Koiner
A. C. Lanier
H. N. Latey
P. Lebenbaum
M. J. Levy
A. D. T. Libby
F. A. Lindberg
D. L. Lindquist
P. MacGahan
M. P. MacKay
M. MacLaren
R. H. Marvin
J. E. Mateer
W. McClellan
B. T. McCormick
R. McCulloch
P. C. McNulty
F. A. Merrick
A. S. Miller
W. J. Mowbray
Paul J. Myler
N. E. Newton
R. H. Nexsen
L. C. Nicholson
L. D. Nordstrum
W. J. Norton
I. Notomi
E. B. Paine
J. C. Parker
A. E. Peirce
J. W. Perry
G. G. Ponti
H. W. Price
E. J. Prindle
H. Rawson
R. H. Rice
C. W. Ricker
S. Howard Rippey
Julian Roe
G. A. Sawin
C. J. Schaus
D. F. Schick
C. A. Schneider
E. H. Schwarz
J. H. Siegfried
A. B. Smith
J. C. Smith
G. Staunton
G. F. Steele
Cabot Stevens
R. J. Strike
E. D. Swinburne
H. B. Van Etten
E. B. Walker
H. B. Waters
Burr Wheeler
F. W. Willis
C. H. Wright
R. I. Wright
H. Wurdack
J. W. Young
G. J. Yundt

Great Lakes District Meeting to Be Held in Minneapolis

The Great Lakes District, AIEE, will hold a three-day meeting and Student Branch convention in Minneapolis, Minn., September 27–29, 1939. Headquarters for the meeting will be in the Hotel Nicollet.

Minneapolis, gateway to the land of 10,000 lakes, is termed the commercial, financial, educational, and cultural center of the Northwest. Among features of interest to visitors may be mentioned the flour mills located on the Mississippi River at St. Anthony Falls, the University of Minnesota, the Minneapolis Symphony Orchestra, the Minneapolis boulevard and Park systems, historic Fort Snelling, the "Twin City" of St. Paul, Lake Minnetonka, and Minnehaha Falls. Transportation facilities to the Twin Cities are modern and convenient.

An attractive program of technical sessions, inspection trips, entertainment, and sports is offered. Tentative plans call for five technical sessions and two student sessions. In scheduling papers for the former the varied interests of engineers have been carefully considered. The detailed program will be announced later.

Meeting headquarters will be at Hotel Nicollet, Minneapolis, Minn.

Members of the District Meeting committee are: C. E. Nelson, *chairman*; J. M. Bryant, R. E. Burlingame, E. G. Hagensick, and chairmen of the subcommittees: I. B. Garthus, meetings and papers; H. W. Meyer, entertainment; E. G. Hagensick, transportation and inspection; J. H. Kuhlmann, student sessions; Truman Hibbard, finance; Allen Dewars, publicity; Mrs. H. W. Meyer, ladies' entertainment; and R. E. Burlingame, hotels and registration.

Middle Eastern District to Meet in Scranton, Pa.

The Lehigh Valley Section of the AIEE will be host to a three-day meeting of the Middle Eastern District, to be held in Scranton, Pa., October 11–13, 1939, with the meeting headquarters in the Hotel Casey.

The general committee, of which E. F. DeTurk of Reading is chairman, recently appointed the following committee chairmen: M. O'Toole, entertainment and reception; W. H. Lesser, transportation and inspection trips; J. W. Mills, hotels and reservations; G. E. Northup, publicity and attendance; J. G. Charest, meetings and papers; N. S. Hibshman, student sessions; and E. F. Weaver, finance.

The tentative program will include nine technical sessions, five inspection trips, reception and entertainment, informal dinner-dance, with social events and inspec-

tion trips being arranged for the women guests by Mrs. G. E. Northrup, chairman of the women's committee.

The Lehigh Valley Section of the AIEE includes, among others, the cities of Wilkes-Barre, Hazleton, Easton, Bethlehem, Allentown, Reading, Sunbury, and Williamsport. The Middle Eastern District includes Philadelphia, Pittsburgh, and Erie, Pa., Washington, D. C., Baltimore, Md., Charleston, W. Va., and Cleveland, Columbus, Toledo, and Akron, Ohio. This is the second occasion upon which the Lehigh Valley Section has been host to the Middle Eastern District, the first being in April 1927, at Bethlehem, Pa., with 400 in attendance. It is estimated that the Scranton meeting will have a registration of 350.

Stoekle Fellowship Fund. The Engineers Society of Milwaukee, Wis., with which the AIEE Milwaukee Section is affiliated, has been made trustee of a fund for a fellowship in memory of Doctor E. R. Stoekle (M'17, F'33), vice-president of Globe-Union, Inc., who died March 14, 1938. The fund provides for an annual grant of up to $400. Beneficiaries, to be selected by the scholarship committee, must be graduates of a secondary school in the County of Milwaukee, and residents of the county at the time of graduation. As the award is not limited to recent graduates, students of science and engineering schools are eligible.

Research Group Visits Laboratories. Members and guests of the Industrial Research Institute, an affiliate of the National Research Council formed last year to exchange ideas on laboratory management, made a tour of industrial laboratories May 16–20, 1939. The trip included visits to the laboratories of the Hoover Company, Canton, Ohio, the Jones and Laughlin Steel Corporation, Pittsburgh, Pa., and the Hercules Powder Company, Wilmington, Del., and ended with meetings at the National Academy of Science, Washington, D. C.

Future Meetings of Other Societies

American Institute of Mining and Metallurgical Engineers. 151st general meeting, July 10–13, San Francisco, Calif.

American Society of Civil Engineers. Annual convention, July 26–29, San Francisco, Calif.

American Society of Heating and Ventilating Engineers. Semiannual meeting, July 4–6, Mackinac Island, Mich.

American Society of Mechanical Engineers. Semiannual meeting, July 10–15, San Francisco, Calif.

Fall meeting, September 4–8, New York, N. Y.

Joint meeting ASME Fuels Division, AIME Coal Division, October 5–7, Columbus, Ohio.

Illuminating Engineering Society. 33d annual convention, August 21–25, San Francisco, Calif.

Institute of Radio Engineers. 14th annual convention, September 20–23, New York, N. Y.

National Electrical Contractors Association. October 9–12, Philadelphia, Pa.

National Electrical Manufacturers Association. October 23–27, Chicago, Ill.

National Safety Council. October 16–20, Atlantic City, N. J.

Society of Automotive Engineers. Tractor meeting, September 28–29, Detroit, Mich.

National aircraft production meeting, October 5–7, Los Angeles, Calif.

Transportation and maintenance meeting, October 26–27, St. Louis, Mo.

Standards

Co-ordination of Reference Values in Institute Standards

Continuing the series of articles begun several months ago on the standards work of the AIEE, this month's item calls attention to a lack of co-ordination of reference values in AIEE standards, and announces the appointment of a subcommittee by the chairman of the standards committee to co-ordinate reference values. It was prepared by J. Franklin Meyer, physicist, National Bureau of Standards, Washington, D. C., and chairman of the new subcommittee.

Although the Institute has been making standards for many years and although these standards have been widely accepted in the electrical industry, there has been little or no concentrated effort on the part of the standards committee nor on the part of any of the technical committees to co-ordinate differences that exist in the Institute standards. This lack of uniformity in what may be called "reference values" such as temperatures, pressures, humidities, altitudes, etc., detracts from the usefulness of the standards and may result in misunderstandings and consequent confusion.

Chairman R. E. Hellmund of the standards committee has taken cognizance of these conditions and has appointed a number of subcommittees to attempt to improve the existing situation. Among the subcommittees appointed is one to study "reference values for standards." In addition to the chairman, this subcommittee consists of the chairmen of the Institute's technical committees, or a representative appointed by the chairman of a particular technical committee, and the following additional persons: P. L. Bellaschi of the Westinghouse Electric and Manufacturing Company, Sharon, Pa.; I. Melville Stein of Leeds and Northrup Company, Philadelphia, Pa.; P. L. Alger of the General Electric Company, Schenectady, N. Y.; and F. M. Farmer of Electrical Testing Laboratories, New York, N. Y.

The chairmen of the various technical committees of the Institute, being more familiar with the details of the AIEE standards in their respective fields than any one else, will be asked to furnish for the use of the committee detailed information on the "reference values" used in these standards.

Other members of the subcommittee have first-hand knowledge of reference values as they now exist in practice and in standards of other organizations, both national and international. All this material will be cumulated and later analyzed, so that a complete summary may become available and perhaps published in a later issue of ELECTRICAL ENGINEERING. The co-operation of all interested engineers is invited.

American Engineering Council

Personnel Changes in SEC

To take the place of former chairman William O. Douglas, now a member of the Supreme Court, President Roosevelt has appointed as member of the Securities and Exchange Commission Leon Henderson, who had been executive secretary of the Temporary National Economic Committee. As soon as Mr. Henderson was sworn in the SEC members, by a vote of 3 to 2, elected Jerome Frank as their new chairman. Both men are ranked as ardent supporters of President Roosevelt so the conduct of SEC policies will continue along the lines laid out under the chairmanship of Mr. Douglas.

Besides its supervision over stock exchanges and security issues, the SEC is charged with the enforcement of that part of the Public Utilities Holding Company Act dealing with the simplification of corporate structures in the utilities field. Chairman Frank announced, shortly after his election, that the SEC will shortly begin conferences with utility executives for the consideration of reorganization plans submitted last December, and since then under study by the SEC staff.

McClellan Heads Union Electric

William McClellan (A'04, F'12), president of American Engineering Council and past-president of the AIEE, has resigned as president of the Potomac Electric Power Company, Washington, D. C., to become the head of the Union Electric Company of Missouri, with headquarters in St. Louis. Both companies are subsidiaries of the North American Company.

This move took place as the result of a complaint by the Securities and Exchange Commission that the Union company had made political campaign contributions in violation of law. President Louis H. Egan (A'08, M'15) and Vice-Presidents Frank J. Boehm (M'25) and Albert C. Laun of the Union Electric Company resigned pending the investigation of the charges. The two vice-presidents were replaced by Edward T. Gushee, vice-president of the Detroit Edison Company, and John A. Woodbridge, of the law firm of Sullivan & Cromwell, counsel for the North American Company.

Report of the Board of Directors

THE board of directors of the American Institute of Electrical Engineers presents herewith to the membership its 55th annual report, for the fiscal year ending April 30, 1939. A general balance sheet showing the condition of the Institute's finances on April 30, 1939, together with other detailed financial statements, is included herein. This report contains a brief summary of the principal activities of the Institute during the year, more detailed information having been published from month to month in ELECTRICAL ENGINEERING.

BOARD OF DIRECTORS' MEETINGS

During the year, the board of directors held five meetings, four in New York City, and one in Washington, D. C. The executive committee meetings in December and March were held in place of regular meetings of the board. Information regarding many of the more important activities of the Institute which have been under consideration by the board of directors and the committees is published each month in the section of ELECTRICAL ENGINEERING devoted to "News of Institute and Related Activities."

PRESIDENT'S AND NATIONAL SECRETARY'S VISITS

President Parker and Secretary Henline attended the Pacific Coast and winter conventions, the Southern District meeting in Miami, and the South West District meeting in Houston, Texas. They also visited many Sections and Student Branches. During May and June, they will attend the North Eastern District meeting in Springfield, Mass., and the combined Summer and Pacific Coast convention in San Francisco, Calif. Visits will be made to the following Sections: Cincinnati, Cleveland, Erie, Mansfield, Rochester, Toledo, and Worcester.

The places visited by President Parker are listed below:

Alabama
- Joint meeting Alabama, East Tennessee, Memphis, and Muscle Shoals Sections, Huntsville
- Alabama Section, Birmingham
- University of Alabama Branch

Colorado
- Denver Section

District of Columbia
- Conference on student activities, District No. 2
- Washington Section
- American Engineering Council

Florida
- Southern District meeting, Miami

Georgia
- Georgia Section, Atlanta

Illinois
- Chicago Section

Louisiana
- New Orleans Section
- Tulane University Branch

Maryland
- Baltimore and Washington Sections, joint meeting, Baltimore
- Johns Hopkins University Branch, and representatives of Catholic University of America, George Washington University, and University of Maryland Branches, Baltimore

Massachusetts
- Boston Section
- Worcester Section
- Worcester Polytechnic Institute
- Massachusetts Institute of Technology Branch and representatives of Tufts, Northeastern, and Harvard University Branches, Cambridge

Michigan
- Michigan Section, Detroit
- University of Michigan Branch

Missouri
- Kansas City Section
- St. Louis Section

Nebraska
- Nebraska Section, Omaha

New York
- New York Section
- Winter convention

Oregon
- Pacific Coast convention, Portland

Pennsylvania
- Philadelphia Section
- Pittsburgh Section (jointly with neighboring Branches)

Tennessee
- Memphis Section

Texas
- South West District meeting, Houston

Utah
- Utah Section, Salt Lake City

Virginia
- Virginia Section, Richmond
- Virginia Military Institute Branch
- Virginia Polytechnic Institute Branch
- University of Virginia Branch

Canada
- Annual meeting, Engineering Institute of Canada, Ottawa

The places visited by the national secretary are the following:

Arkansas
- University of Arkansas Branch

District of Columbia
- Conference on student activities, District No 2
- Washington Section
- American Engineering Council

Florida
- Southern District meeting, Miami

Georgia
- Georgia Section, Atlanta

Kansas
- Wichita Section

Kentucky
- Louisville Section
- University of Kentucky Branch

Maryland
- Baltimore and Washington Sections, joint meeting, Baltimore
- Johns Hopkins University Branch, and representatives of Catholic University of America, George Washington University, and University of Maryland Branches, Baltimore

Massachusetts
- North Eastern District executive committee meeting, Pittsfield

New York
- New York Section
- Winter convention

Oregon
- Pacific Coast convention, Portland

Pennsylvania
- Philadelphia Section

Texas
- South West District meeting, Houston
- San Antonio Section

Virginia
- Virginia Section, Richmond
- Virginia Military Institute Branch
- Virginia Polytechnic Institute Branch
- University of Virginia Branch

Canada
- Annual meeting, Engineering Institute of Canada Ottawa

NATIONAL CONVENTIONS

Three national conventions were held during the year, and a brief report on each follows:

Summer Convention. The 54th summer convention was held in Washington, D. C., June 20–24, 1938. In addition to the annual business meeting, conference of officers, delegates, and members, a conference of vice-presidents, district secretaries, and counselor delegates, there were 10 technical sessions, at which 48 papers were presented, one general session, and six conference sessions. The general session consisted of addresses by President W. H. Harrison, Dr. W. R. Gregg, chief of the weather bureau, and Colonel J. M. Johnson, assistant secretary of commerce.

Entertainment features of the convention were a luncheon, dance, banquet, at which the Gaston Plante Medal and 4,500-franc prize was presented to Dr. G. W. Vinal, tea, golf and tennis tournaments. The registration was 825.

Annual Meeting. The annual business meeting of the Institute was held on Tuesday morning, June 21. The annual report of the board of directors for the fiscal year which ended April 30, 1938, was presented in abstract by the national secretary. A report on the finances of the Institute was presented by National Treasurer W. I. Slichter. The report of the committee of tellers upon the election of officers for the year beginning August 1, 1938, was presented, and President-Elect Parker responded to his introduction with a brief address. During this session, the Lamme Medal for 1937 was presented to Dr. R. E. Doherty, president, Carnegie Institute of Technology, Pittsburgh, Pa.

Pacific Coast Convention. The 26th Pacific Coast convention was held in Portland, Oregon, August 9–12, 1938, with a registration of 454. Five technical sessions, including 22 papers, two student technical sessions, a general session, a joint conference on student activities, reception and dancing, buffet supper, banquet, inspection trips, golf tournament, and ladies' events constituted the principal features of the convention. A technical session on communication was held jointly with the Institute of Radio Engineers.

Winter Convention. The 27th winter convention was held in New York City, January 23–27, 1939, with a program including 77 papers in 17 technical sessions, two general sessions, and 5 technical conferences. During a general session on Wednesday morning, a brief address was given by President Parker, and Dr. Virgil Jordan, president of the National Industrial Conference Board, Inc., gave an address on "Enterprise and Social Progress." A second general session on Thursday afternoon was devoted to engineering conclusions drawn from the experiences encountered during the New England hurricane of September 21, 1938. The 6 speakers in-

cluded American Red Cross, railroad, power utility, and telephone representatives.

At an evening session, the Edison Medal was presented to Past-President Dugald C. Jackson, and the John Fritz Medal was presented to Past-President F. B. Jewett.

A smoker, numerous inspection trips, and ladies' events completed the program of the convention, which had a registration of 1,610, the largest since 1924.

District Meetings

Brief reports on the three District meetings held during the year are given below:

North Eastern District Meeting. This meeting was held in Lenox, Mass., May 18–20, 1938, with 3 technical sessions, at which 13 papers were presented, one session for student papers, and a general session with addresses by Roger Babson and K. K. Darrow, an informal banquet, stag smoker, District conference on student activities, inspection trips, and ladies' events. The registration was 417.

Southern District Meeting. This meeting was held in Miami, Florida, November 28–30, 1938, with 4 sessions, at which 10 papers and 4 addresses were presented, and a student session. A conference on student activities, inspection trips, banquet and dance, and ladies' events were included in the program. The registration was 258.

South West District Meeting. The meeting of this District was held in Houston, Texas, April 17–19, 1939, with 5 technical sessions, at which 15 papers and one address were presented, 2 symposiums, and 3 additional sessions for the presentation of 14 student papers, a dinner dance, inspection trips, sports, and ladies' events. The registration was 536.

Sections

Organization of the San Diego and Mansfield Sections, in January and March, respectively, brought the total number to 67. Beginning activities late in 1938 as the Mansfield division of the Cleveland Section, the members in that vicinity soon aroused much interest and secured many new members. The formation of a Section was authorized by the Institute executive committee on March 6.

All of the Sections have been active, and the total number of meetings reported to headquarters was 635, a slight increase over the 624 for the preceding year, and the 621 for 1936–37. The latter was far larger than the highest previous number, 540.

The name of the Detroit-Ann Arbor Section was changed to Michigan Section, with no change in territory.

Interest in the activities of technical groups within the Sections and in the holding of special technical meetings has continued to expand. Several Sections continued their arrangements for offering courses of instruction desired by their membership. The award of prizes by some Sections and co-operation between Sections and Branches in many localities were continued with good results.

The committee on safety wrote the Sections suggesting that each have presented each year a paper dealing with accident prevention or remedial measures after electrical shock. Replies indicated that many Sections were arranging to carry out this suggestion.

Three topics of current lively interest are before the Sections as was indicated at the meeting of the Sections Committee in New York at the time of the winter convention:

Unassigned Territory. Chairman Race presented a map showing the territories in the United States not now assigned to any Section.

The general policy was endorsed that wherever practicable the members in such territories should receive notices from and be made to feel a part of the Section nearest to them. In large areas such as the states of South Carolina and West Virginia, Sections should be formed as early as there is sufficient local interest and justification.

In smaller areas such as groups of counties in Maine, New Hampshire, Vermont, and Pennsylvania, the chairman was empowered to consult with the vice-president and Section officers concerned to allocate to the nearest Section such auxiliary territory.

On January 9th, President Parker addressed a letter to Institute members in the unassigned territories requesting suggestions as to how the Institute could be of greater service to those individuals who because of location find it difficult to attend Section meetings. The Sections' opportunity in this respect is indicated in the previous discussion.

Section Activities. Chairman Race presented a chart summarizing the information received to date on Section activities in response to his letter of December 27, 1938. The object of this effort is to inform all Sections on the projects that have proved most interesting and helpful. The suggestion has been made that the Sections committee undertake the preparation of a pamphlet summarizing these numerous and diverse activities so as to make available to incoming Section officers the background of experience of all Sections.

Registration of Engineers. Mr. Beardsley reported on the present status of the licensing of professional engineers. He said that the National Council of State Boards of Engineering Examiners had invited the Institute to co-operate in the formulation of examinations for candidates for the license. Also the board of directors of the Institute had authorized funds for the printing and distribution to Section officers of copies of the latest revision of the AIEE model law. Professor Timbie was appointed to represent the Sections committee to assist in this project.

More detailed information on these activities may be found in the annual report on Section and Branch activities in the June issue of Electrical Engineering, pages 268–71.

Table I. Section and Branch Statistics

	For Fiscal Year Ending			
	April 30, 1936	April 30, 1937	April 30, 1938	April 30, 1939
Sections				
Number of Sections	61	62	65	67
Number of Section meetings held	540	621	624	635
Total attendance	85,501	74,950	110,148	85,692
Branches				
Number of Branches	118	119	120	120
Number of Branch meetings held	1,045	1,363	1,334	1,190
Total attendance	45,304	46,121	60,446	53,380

Student Activities

A new Branch organized at the New Mexico State College restored the total number to 120, after the University of North Carolina Branch had been discontinued due to consolidation of the engineering school with that of the North Carolina State College.

Only one Branch failed to report any activity, but the total number of meetings, 1,190, was much lower than in each of the preceding fiscal years, 1,363 in 1936–37, and 1,334 in 1937–38. There was also a material reduction in the number of student talks at Branch meetings.

As indicated in the reports on national conventions and District meetings, the interest in student technical papers has continued, and the following sessions were held:

North Eastern District meeting in Lenox, one; Pacific Coast convention, Portland, two; Southern District meeting, Miami, one, and South West District meeting, Houston, three.

With the approval of the committee on Student Branches, the committee on safety again suggested to all counselors that each Branch have presented a paper dealing with the prevention of accidents or remedial measures after electrical shock. Gratifying responses were received from many Branches.

The midwinter meeting of the committee on Student Branches, held January 26th, was attended by 52 members and invited guests. The meeting was made general to include all those present, and business was transacted as reported on page 124 of Electrical Engineering for March. Pursuant to the actions taken at that time, a committee is making good progress in rewriting the pamphlet "The Electrical Engineer," which it is expected will be ready for distribution during the coming summer. Another committee, including A. C. Stevens, chairman, F. C. Caldwell, A. G. Conrad, C. E. Skinner, and C. C. Whipple, is busily engaged in preparing a suitable description of the work of Dr. C. F. Scott, the founder of AIEE Student Branches, which can be used at Student Branch meetings next year to celebrate Dr. Scott's 75th anniversary.

According to records at headquarters, the terms of 1,564 enrolled students were expected to expire on April 30. Applications for admission as Associates were received from 849, or about 54 per cent. Some of

Table II. Technical Programs, Last Two Years

	Year Ending April 30, 1939	Year Ending April 30, 1938
Number of national conventions	3	3
Number of District meetings	3	2
Registration at national conventions and District meetings	4,100	3,587
Number of papers presented	184	154
Number of papers recommended for TRANSACTIONS	169	143
Number of pages required for printing papers in TRANSACTIONS	986*	935
Number of technical sessions	50	43
Number of technical conferences	12	8

* Partly estimated.

the students were eligible to continue enrollment as they had remained in school. The corresponding percentage for the preceding fiscal year was 48.

Student activities are summarized more thoroughly in the annual report on Section and Branch activities in the June issue of ELECTRICAL ENGINEERING, pages 268–71.

TECHNICAL PROGRAM COMMITTEE

Convention Programs. The technical program at the 1939 winter convention was more extensive and diversified than at any previous Institute convention. There was a total of 24 sessions—17 technical sessions, at which 77 technical papers were presented and discussed, 5 technical conferences, and 2 general sessions. This exceptional program met with a correspondingly exceptional response from the membership, as is indicated by the fact that registration at the convention was greater than at any convention since 1924. The unusually large technical program did not, by any means, exhaust the committee's fund of papers. After the formation of the winter convention program, there still remained on hand 25 high-grade papers which were held over for use at subsequent meetings.

In addition to the winter convention, the committee arranged programs for the 1938 summer and Pacific Coast conventions, and assisted in the provision of programs for district meetings at Lenox, Mass.; Miami, Florida; and Houston, Texas. A total of 184 papers were presented at these meetings, of which 169 were recommended by the committee for inclusion in TRANSACTIONS.

Technical conferences continue to be an important feature of the technical programs. A total of 12 were held during the year.

The registration at national conventions and District meetings showed an increase of about 15 per cent as compared with the previous year. This is attributable to some extent to the fact that there was one more District meeting than in the previous year. A very great increase in the attendance at the Pacific Coast convention (over 70 per cent) and a 12 per cent increase in the attendance at the winter convention was experienced. Data on attendance and other statistics are shown in table II.

Advance Copies of Technical Papers. Beginning with the 1938 summer convention in Washington, last year was the first year during which the new procedure relative to the provision of advance copies of technical papers was completely in force. The year's experience has proved the value of this procedure. This is indicated by the fact that a total of 61,000 preprints have been distributed during the past year, an average of 330 copies per technical paper. From the standpoint of authors, the new procedure is advantageous since it shortens from 90 to 60 days the minimum interval between the time when a paper is submitted to the Institute and the time when it may be presented. This latter advantage has been made effective through the adoption during the year of a revision of Section 93 of the bylaws as recommended by the committee.

This year, under the new procedure, preprints have been made available not only of all technical papers presented at national conventions but also of all papers presented at District meetings. This feature has been much prized by the District committees, and it is recommended that it be continued in so far as budget conditions permit.

General Sessions. In accordance with the general policy recommended by the committee and approved by the board of directors in 1937, "sessions at which subjects of general interest to all members are discussed" were arranged by the committee for the 1938 summer convention and the 1939 winter convention. At the 1938 summer convention, addresses were given by Dr. W. R. Gregg, Chief of the U.S. Weather Bureau, and Colonel J. M. Johnson, Assistant Secretary of the Department of Commerce, who spoke on weather forecasting, and aviation, respectively.

At the 1939 winter convention, the committee arranged for an address by Dr. Virgil Jordan on "Enterprise and Social Progress," and for a series of addresses constituting a symposium on the hurricane of September 1938. The speakers at the latter session were Mr. Walter Wesselius, of the American Red Cross, and Messrs. Sidney Withington, E. W. Doebler, C. W. Brown, T. H. Haines, and W. H. Harrison, who among them represented the power, railroad, and communication utilities, and who related the experiences of these utilities as a result of the hurricane. These general sessions have been very popular, attractive, interesting, and valuable additions to convention programs.

Manual of the Technical Program Committee. The committee has in preparation a revised manual of the practices and regulations which govern its operations. It is expected that the manual will be completed and submitted for duplication before the expiration of the committee's term of office. The committee's objective is to include in the manual all the information ordinarily needed by members of the technical program committee, technical committees, and District meeting committees in connection with the planning, procurement, and consideration of material for and conduct of technical sessions and conferences at national conventions and District meetings of the Institute.

Acknowledgment. The effectiveness of the committee's work has been the result of the efforts and devotion of many people—of its members, of course, of the chairmen of the technical committees, of the members of the technical committees, and of other cooperating committees, of the Institute's staff, and in particular of its secretary, Mr. Rich.

Table III. Membership Statistics for the Fiscal Year Ending April 30, 1939

	Honorary	Fellow	Member	Six-Year Associate	Associate	Total
Membership on April 30, 1938	9	710	4,316	5,736	5,307	16,078
Additions						
Transferred	1	33	136	376		
New members qualified		1	100	35	1,265	
Former members reinstated			8	22	11	
	10	744	4,560	6,169	6,583	18,066
Deductions						
Died	1	18	42	43	13	
Resigned		2	45	145	107	
Transferred		1	29	127	389	
Dropped		1	52	187	259	
Membership on April 30, 1939	9	722	4,392	5,667	5,815	16,605

Table IV. Number of Applications Received From Enrolled Students and From All Others

Year Ending	From Students	From All Others	Total
April 30, 1939	849	872	1,721
April 30, 1938	739	932	1,671
April 30, 1937	716	1,040	1,756
April 30, 1936	631	946	1,577
April 30, 1935	575	715	1,290

Table V. Number of Enrolled Students

April 30, 1939	5,242	(2,271)
April 30, 1938	5,037	(2,428)
April 30, 1937	4,503	(2,249)
April 30, 1936	4,049	(1,991)
April 30, 1935	3,806	(1,983)

Following the number of Students reported for April 30 of each year is indicated within parentheses the number of new applications received during that year; the difference between this number and the reported total, of course, reflects the number of renewals of Student enrollment for the corresponding period.

Publication Committee

The principal activity of the publication committee during the year has been the effort to bring to full fruition the improved publication service to our members made possible by the publication policy approved by the board of directors in the fall of 1937.

As a result of the change in policy, many changes in publication procedure were necessary, and, because it was quite impossible to make all of the changes simultaneously, Electrical Engineering and the Transactions for the year 1938 are, to some extent, non-uniform, part reflecting the old policy and part the new.

Starting with the September 1938 issue, Electrical Engineering assumed its present standard form. The final change was a shift from a two-column to a three-column format for the technical program papers and discussions. Some had found the reading of the discussions somewhat difficult because of the small type size. Considering ease of reading, it is well established that there is a definite relation between the type size and column width, a wider column requiring a somewhat larger size of type. In this case, the column width was reduced, which gave the desired improvement in readability without incurring the additional expense that would have been involved in enlarging the size of type used for discussions. In fact, a small saving was made by using a slightly smaller size of type for the body of the technical program papers, the combined effect of the new type size and the narrower column being to increase the ease of reading here also. A special effort was made to get the reaction of the members to this change in typography, and, almost without exception, the responses were very favorable.

Special attention has been given to developing the general interest section of Electrical Engineering, and here again, with very few exceptions, the comments of members have been favorable. The very few cases of adverse criticism of our publications under the new publication policy have been due in almost every instance to a lack of understanding of all of the provisions of the publication policy. To take care of this situation, plans are under way to include a full statement of the publication policy in the pamphlet "Suggestions to Authors," which is regularly issued by the Institute. It is probable that this more comprehensive pamphlet will be available by late summer or early fall.

The Institute has not published a cumulative index of the Transactions since 1921, and there have been numerous requests for such an index. During the year, the publication committee sent a questionnaire to the membership to determine the amount of interest in a 17-year cumulative index to cover the years 1921–38, inclusive. The publication committee is happy to report that the response to the questionnaire was such as to indicate that the 17-year cumulative index could be made available on a practically self-supporting basis. As a result, the board of directors, at its January 1939 meeting, approved the publication of the index, and copies are now available.

The same questionnaire made inquiry as to the interest of the membership in a Transactions supplement, which would include all of those technical program papers for the year 1938 which did not appear in Electrical Engineering. The response to this inquiry was also favorable, with the result that those members who do not wish to purchase the bound volume of Transactions may obtain the Transactions supplement at a price of $0.50, and this supplement, together with the 12 issues of Electrical Engineering, will give them a complete file of the technical program papers for the year.

The publication committee wishes to thank the membership for its splendid co-operation in the work of making effective the changes called for by the new publication policy. This co-operation has made the task of the publication committee a great deal lighter than it otherwise would have been.

Table VI. Number of Members in Section Territory Reinstated

August 1, 1938 to April 30, 1939	293
Year Beginning August 1, 1937	325
Year Beginning August 1, 1936	503
Year Beginning August 1, 1935	663
Year Beginning August 1, 1934	831

Membership Committee

The membership committee has put forth special effort this year to overcome the effects of current economic conditions on new membership results. Current business conditions are reflected in the reduction in applications received in 1937–38, and by a reduction in the percentage of members whose dues are fully paid as of April 30, 1939, as will be noted in tables IV and VIII.

The Section committees were organized early this year and were given complete written instructions regarding their work, together with the needed literature, to avoid any delay in getting started. Contacts with the students eligible for Associate grade were organized carefully to assure that each man would be reminded on several occasions of the importance of early affiliation with the Institute. The aid of the Branch counselors was enlisted in these contacts. Their response was splendid, and their efforts did much to assist this phase of the work.

Table VIII. Memberships Fully Paid

	Membership as of April 30	Number of Members Fully Paid as of April 30	Per Cent Fully Paid
1939	16,605	14,371	86.5
1938	16,078	14,127	87.9
1937	15,308	13,439	87.8
1936	14,600	12,446	85.2
1935	14,269	11,512	80.7
1927 (year of maximum membership)	18,344	16,247	88.6

Table VII. Membership of the Institute, April 30, 1939

Of the 16,605 members reported for April 30, 1939, 14,371 are fully paid to April 30, 1939. The balance of 2,234 are divided into the following groups:

1. Members owing dues to April 30, 1938
Total number of members who have not acted upon resolution of board of directors adopted in January 1939 providing an extension of time for payment of these dues 666

2. Members owing dues to April 30, 1939 1,568

(During the period May 1 to 20, 1939, 397 members have paid dues to April 30, 1939, reducing the total to 1,171.)

The national committee was organized as last year with 21 members, 9 of whom were new additions. An organization meeting was held in September 1938, and another meeting was called during the winter convention, in January 1939, to review the progress made to date and to plan the work for the remainder of the year. No important changes have been made in the method of conducting the committee's work.

The Section membership committees have co-operated with the committee on transfers in encouraging eligible members to transfer to their proper grade of membership.

Table IV shows the large increase of applications received from enrolled students, which is due both to the increased activity already mentioned and to about 7½ per cent more prospects being available as compared with last year. The reduction in applications received "From All Others" is due largely to reduced returns from the Northeastern industrial section of the country. The total applications received is above last year's record by 50, but is 35 under the number received in 1936–37.

The total Institute membership has increased to 16,605, as compared with 16,078 on April 30, 1938—see table III.

The committee is pleased to see another healthy increase in the number of enrolled students—table V—since these men form the best source for future Associates.

Table VI shows a relatively small change in the number of delinquents reinstated in

Table IX. Record of AIEE Membership

Total Membership May 1		Total Membership May 1		Total Membership May 1	
1884	71	1904	3,027	1923	15,298
1885	209	1905	3,460	1924	16,455
1886	250	1906	3,870	1925	17,319
1887	314	1907	4,521	1926	18,158
1889	333	1908	5,674	1927	18,344
1890	427	1909	6,400	1928	18,265
1891	541	1910	6,681	1929	18,133
1892	615	1911	7,117	1930	18,003
1893	673	1912	7,459	1931	18,334
1894	800	1913	7,654	1932	17,550
1895	944	1914	7,876	1933	17,019
1896	1,035	1915	8,054	1934	15,200
1897	1,073	1916	8,202	1935	14,269
1898	1,098	1917	8,710	1936	14,600
1899	1,133	1918	9,282	1937	15,308
1900	1,183	1919	10,352	1938	16,078
1901	1,260	1920	11,345	1939	16,605
1902	1,549	1921	13,215		
1903	2,229	1922	14,263		

comparison with the annual reductions of the past few years. The top figure of 293 is for nine months only and compares closely with 306 for the same period one year ago. The figures in this table may be expected to change little, or even to increase if business conditions cause an increasing number to become delinquent.

Table VII indicates again, as does table VIII, that there is a tendency on the part of a larger number to let dues payments wait. Last year, only 470 had not accepted the offer passed by the board of directors in January 1938, and 1,481 owed dues to April 30, 1938 (this latter number had been reduced to 1,211 by May 17, 1938). This condition should improve when world and business conditions become more stable.

Deaths

The deaths of 117 members reported during the year are listed in table X.

Committee on Transfers

Since the last report, the membership has voted amendments to the constitution, Section 4 of Article II and Section 10 of Article III, providing that application for transfer to grade of Fellow shall result only from proposal, and that at least five years of Member grade shall be a requirement; this with certain exceptions. These provisions, published in Electrical Engineering, July 1938, pages 303–04, became effective July 21, 1938.

Material relative to Section transfer committee activity has been regularly circulated to all Section chairmen.

In order to ascertain the status of transfer committees in the Sections, questionnaire letters were sent to the Section chairmen. These were returned with results as follows:

56 Sections reported.

Of these, 19 have Section transfer committees, 16 receiving aid from the Section membership committee.

37 have no Section transfer committee. Of these, 33 Sections look to the Section membership committee for transfer responsibility. Twelve of these are discussing the matter or planning on having Section transfer committees.

The results of this survey would indicate that either through the Section transfer committee or the Section membership committee, as seems best to the Section executive committee, the coverage of transfer activities in the Sections is quite complete, needing only stimulation for increased performance.

The number of applications for transfer since 1927 is shown in table XI.

Board of Examiners

The board of examiners held 11 meetings during the past year, averaging about two and one-half hours each, and considered 3,820 cases, divided as shown in table XII.

Standards Committee

The increasing interest and activity of the various technical committees of the Institute in standardization which was reported during the previous year has been mani-

Table X. Deaths of AIEE Members Reported During the Fiscal Year

Name	Date of Election	Date of Death	Grade at Death	Obituary Notice in Electrical Engineering
Aanonsen, Hans E.	Associate '07		Associate	Jan. 1939, p. 53
Abell, Harry C.	Associate '03	Nov. 24, 1938	Associate	Jan. 1939, p. 53
Ahearn, Thomas	Associate '87	June 28, 1938	Member	Aug. 1938, p. 363
Alderman, Haywood L.	Associate '27	Jan. 11, 1939	Member	Feb. 1939, p. 93
Alexander, James P.	Member '21	Oct. 8, 1938	Member	Dec. 1938, p. 523
Battern, Algy R.	Associate '20		Associate	Aug. 1938, p. 364
Benham, Claude F.	Associate '16	Sept. 12, 1938	Member	Nov. 1938, p. 473
Bird, Montgomery R.	Associate '36	Nov. 27, 1936	Associate	Dec. 1938, p. 524
Blondel, Andre E.	Associate '05	Nov. 15, 1938	Honorary Member	Feb. 1939, p. 93
Bracken, James L. F.	Associate '18	Oct. 21, 1938	Associate	Dec. 1938, p. 523
Brandenburger, Leo.	Associate '37	Feb. 11, 1938	Associate	Oct. 1938, p. 436
Bronson, Frederick M.	Member '36	Oct. 23, 1938	Member	Dec. 1938, p. 523
Brown, Glendon C.	Member '37	1938	Member	March 1939, p. 141
Brubaker, Charles N.	Associate '19	May 3, 1938	Member	Aug. 1938, p. 364
Buck, Nelson E.	Associate '19	Dec. 12, 1938	Associate	March 1939, p. 141
Burt, Austin	Associate '07	Sept. 1938	Fellow	April 1939, p. 186
Cammack, John E.	Associate '19	March 1939	Associate	May 1939, p. 229
Carpenter, Dan E.	Member '15	Sept. 7, 1938	Member	Oct. 1938, p. 436
Clothier, Henry W.	Member '17	March 11, 1938	Member	June 1938, p. 275
Coates, Charles B.	Associate '03	March 17, 1939	Member	May 1939, p. 229
Collings, Llewellyn W.	Associate '37	Dec. 27, 1938	Associate	Feb. 1939, p. 93
Connolly, Stephen J.	Associate '08	Jan. 29, 1938	Associate	July 1938, p. 325
Crates, Royal R.	Associate '37	March 10, 1939	Associate	May 1939, p. 229
Cunningham, Andrew J.	Associate '35	Dec. 1937	Member	Aug. 1938, p. 364
Dalton, William J.	Associate '24	July 9, 1938	Associate	Sept. 1938, p. 395
Davis, Albert G.	Associate '98	April 25, 1939	Fellow	June 1939, p. 279
Dawson, William F.	Associate '05	Jan. 19, 1939	Fellow	March 1939, p. 141
Deck, Frederick W.	Member '30	Sept. 26, 1938	Member	Nov. 1938, p. 473
Denmann, Burt J.	Associate '11	June 25, 1938	Associate	Aug. 1938, p. 364
Dick, William A.	Associate '02	Dec. 5, 1938	Fellow	May 1939, p. 229
Dickerson, E. N.	Associate '84		Associate	
Dodd, Maynard	Member '24	April 10, 1938	Member	June 1938, p. 275
Doty, Paul	Associate '04	Dec. 3, 1938	Associate	March 1939, p. 140
Ducey, Walter J.	Associate '22	Sept. 29, 1938	Member	Nov. 1938, p. 473
Ellis, Joseph	Associate '17	Oct. 2, 1938	Associate	Jan. 1939, p. 54
Frederiksen, Victor	Associate '32	April 23, 1938	Associate	Oct. 1938, p. 436
Freidenmann, John W.	Member '30	Feb. 13, 1938	Member	June 1938, p. 274
Furness, Douglas L.	Associate '08	June 19, 1938	Associate	Sept. 1938, p. 395
Gallagher, Francis W.	Associate '37	Sept. 18, 1938	Associate	Jan. 1939, p. 54
Gallatin, Albert R.	Associate '98	March 1939	Associate	June 1939, p. 281
Gillespie, Leigh R.	Associate '19	Nov. 1938	Member	Jan. 1939, p. 53
Geisler, Hugo P., Jr.	Member '36	Sept. 10, 1938	Member	Dec. 1938, p. 523
Glaubitz, Hugh J.	Member '17	Jan. 14, 1939	Member	March 1939, p. 140
Green, Richard	Associate '34	March 29, 1938	Associate	July 1938, p. 326
Guttmann, Raymond	Associate '35	Feb. 22, 1938	Associate	Dec. 1938, p. 524
Hardy, Carl E.	Associate '99	Feb. 15, 1939	Associate	April 1939, p. 186
Harris, Charles H.	Associate '34	Oct. 22, 1938	Associate	Dec. 1938, p. 523
Hawkins, Charles C.	Associate '03	Aug. 1938	Associate	Nov. 1938, p. 473
Hayes, Timothy A. J.	Associate '32	April 14, 1938	Associate	June 1938, p. 275
Henning, Clarence I. B.	Associate '13	Jan. 26, 1939	Associate	March 1939, p. 141
Hermann, Henry	Associate '15	Oct. 17, 1938	Associate	April 1939, p. 186
Hirshfeld, Clarence F.	Associate '05	April 19, 1939	Fellow	May 1939, p. 229
Hopewell, Charles F.	Associate '97	Oct. 17, 1938	Member	March 1939, p. 141
Hoppe, Walter H.	Associate '30	Nov. 1938	Associate	Jan. 1939, p. 54
Horne, George H.	Associate '10	Dec. 6, 1938	Associate	Feb. 1939, p. 94
Huseby, Gisle E.	Associate '26	Oct. 2, 1938	Associate	Dec. 1938, p. 524
Hussey, Abram	Associate '06	Aug. 17, 1937	Member	Oct. 1937, p. 1334
Hutchinson, Cary T.	Associate '90	Jan. 16, 1939	Fellow	March 1939, p. 140
Insull, Frederick W.	Member '37	Jan. 14, 1939	Member	March 1939, p. 141
Insull, Samuel	Associate '86	July 15, 1938	Fellow	Aug. 1938, p. 363
Jackson, Ray P.	Associate '06	Nov. 1937	Associate	July 1938, p. 326
Jacoby, S. Clifford	Associate '21	Oct. 20, 1938	Member	Dec. 1938, p. 523
Jennison, Herbert C.	Associate '05	June 12, 1938	Associate	Oct. 1938, p. 437
Jorgensen, Lars R.	Associate '05	May 8, 1938	Member	July 1938, p. 326
Keyes, Clift B.	Associate '03	Dec. 7, 1938	Member	Jan. 1939, p. 53
Killgore, Lloyd M.	Associate '18	March 1938	Associate	Jan. 1939, p. 54
Knaur, Richard J.	Associate '22	April 26, 1938	Associate	Aug. 1938, p. 364
Lackie, Walter J.	Associate '28	May 26, 1938	Associate	Sept. 1938, p. 395
Lanphier, Robert C.	Associate '01	Jan. 28, 1939	Fellow	March 1939, p. 141
Lawton, Arthur H.	Associate '03	Dec. 2, 1938	Fellow	Jan. 1939, p. 53
Maxwell, Eugene	Associate '96	July 28, 1938	Associate	Nov. 1938, p. 473
McQuarrie, James L.	Associate '07	March 1, 1939	Fellow	April 1939, p. 186
Meredith, Gailen E.	Associate '19	April 20, 1938	Member	July 1938, p. 326
Miller, Charles A.	Associate '21	Aug. 23, 1938	Associate	Oct. 1938, p. 437
Mintzner, Watkins F.	Associate '20	Aug. 22, 1938	Associate	Dec. 1938, p. 523
Moody, Walter S.	Associate '06	Nov. 7, 1938	Fellow	Dec. 1938, p. 523
Mordey, William M.	Associate '91	July 1, 1938	Associate	Sept. 1938, p. 395
Morgan, Oliver J.	Associate '36		Associate	April 1939, p. 186
Munshi, Dinshaw P.	Associate '32	Dec. 16, 1937	Associate	Aug. 1938, p. 364
Nagel, William G.	Associate '03	July 20, 1938	Associate	Oct. 1938, p. 437
Packer, Edson F., Jr.	Associate '36	June 13, 1938	Associate	Aug. 1938, p. 364
Panter, Thomas A.	Associate '03	March 12, 1939	Fellow	May 1939, p. 229
Parry, Evan	Associate '95	Dec. 17, 1938	Associate	Feb. 1939, p. 93
Peck, Emerson P.	Associate '08	Nov. 14, 1938	Fellow	June 1939, p. 280
Pike, Clayton W.	Associate '91	Dec. 30, 1938	Member	April 1939, p. 186
Ratcliff, Henry A.	Member '22	April 26, 1938	Member	June 1938, p. 275
Reid, Edwin S.	Associate '96	July 20, 1938	Member	Nov. 1938, p. 473
Robbins, Percy A.	Associate '03	April 23, 1938	Associate	July 1938, p. 325
Roberts, Samuel N.	Associate '21	Jan. 1939	Associate	March 1939, p. 141
Robertson, James T.	Associate '06	Sept. 6, 1938	Member	Nov. 1938, p. 473
Roller, Frank W.	Associate '95	Aug. 21, 1938	Fellow	Sept. 1938, p. 395
Ross, James D.	Associate '08	March 14, 1939	Fellow	April 1939, p. 185
Ruffner, Charles S.	Associate '02	Jan. 21, 1939	Fellow	March 1939, p. 140

Table X (Continued). Deaths of AIEE Members Reported During the Fiscal Year

Name	Date of Election	Date of Death	Grade at Death	Obituary Notice in Electrical Engineering
Ryan, William T.	Associate '07	Feb. 5, 1939	Member	March 1939, p. 140
Seletzky, Anatoli C.	Associate '29	May 11, 1938	Member	June 1938, p. 274
Shearer, Harold H.	Member '20	Nov. 10, 1938	Member	Dec. 1938, p. 523
Shute, Loren H.	Associate '15	Feb. 10, 1939	Associate	June 1939, p. 280
Snell, Sir John F. C.	Associate '06	July 6, 1938	Fellow	Aug. 1938, p. 363
Sterba, Ernest J.	Associate '21	April 24, 1939	Member	June 1939, p. 280
Strasburger, Edgar	Associate '03		Associate	May 1939, p. 229
Sutherland, Wm. J. K.	Associate '15	March, 1938	Associate	Oct. 1938, p. 436
Swallow, Joseph G.	Associate '09	Jan. 14, 1939	Associate	April 1939, p. 186
Terry, Charles A.	Associate '87	Feb. 18, 1939	Member	April 1939, p. 186
Thompson, John H.	Associate '21	Oct. 31, 1938	Associate	Jan. 1939, p. 54
Thornton, Kenneth B.	Associate '01	Feb. 10, 1938	Member	Dec. 1938, p. 523
Thrush, George H., Jr.	Associate '34	Sept. 25, 1938	Associate	Dec. 1938, p. 523
Uhlenhaut, Fritz, Jr.	Associate '89	Jan. 1, 1937	Member	Feb. 1939, p. 94
Upley, Arnold S.	Associate '37		Associate	Dec. 1938, p. 524
Walker, Earle T.	Associate '35	Sept. 22, 1937	Associate	July 1938, p. 326
Warner, John C.	Member '34	July 21, 1938	Member	Sept. 1938, p. 395
Watson, Malcolm V.	Associate '07	April 25, 1938	Member	June 1938, p. 274
Weeks, Edwin R.	Associate '87	Aug. 17, 1938	Fellow	Oct. 1938, p. 436
Whitmore, Walter G.	Associate '90	Nov. 30, 1938	Associate	Feb. 1939, p. 94
Wilbraham, F. M.	Associate '19	Jan. 21, 1939	Associate	April 1939, p. 186
Wilcox, Herbert M.	Member '37	July 28, 1938	Member	Sept. 1938, p. 395
Wittenberg, Michael	Member '24	Jan. 1939	Member	March 1939, p. 141
Young, Walter E.	Associate '19	June 22, 1938	Member	Sept. 1938, p. 395

fested during the present year. There was also increased participation by the Institute in ASA projects through the appointment of representatives on a number of new sectional committees. Of particular interest is the work started in the ASA on lightning arresters, storage batteries, and on a test code for fractional horsepower motors initiated by a subcommittee of the AIEE committee on electrical machinery. A reorganization of the sectional committee on electric welding is now under way. The Institute has also appointed representatives on a sectional committee that will attempt to develop international marine standards as affecting electrical installations on shipboard.

During the year, important new AIEE standards have been issued and others revised as follows: Notably, the completely revised edition of the Marine Rules, a new test code on apparatus noise measurement and standards for oil circuit breakers and indicating instruments.

In accordance with plans made during the previous year, three regular sessions and two symposiums at the winter convention were devoted to discussion of standards for the rating of various types of electrical machinery, especially motors and transformers. A total of 12 formal papers were presented. The sessions were very well attended and a great deal of interest was displayed by the membership at large, indicating that future meetings of similar character will be justified. Several papers relating to standards activities are contemplated for inclusion in the program for the summer convention.

The standards committee, realizing that a certain amount of co-ordination of standardization work carried on by the technical committees is desirable, and also that the Institute might carry on to good advantage some standards activities not ordinarily falling within the scope of the existing technical committees, has organized a number of co-ordinating committees for the following purposes:

(*a*). To compile data on existing conditions and standards which will assist in determining the need for better co-ordination.

(*b*). To prepare guiding principles to be used by the other AIEE committees in their standards work.

(*c*). To maintain contact with all interested AIEE committees and also with national and international standardization agencies outside of the Institute.

(*d*). To recommend, initiate, or sponsor setups in the ASA, IEC, and other standardization bodies which seem desirable or expedient for bringing about maximum co-ordination of standards in the electrical field.

(*e*). To initiate, in co-operation with interested AIEE technical committees, regular or informal Institute sessions for the purpose of discussing vital issues of standardization.

At present these committees cover the following subjects: Reference Values for Standards, Standard Voltages and Currents, Insulation Testing and Co-ordination, and Basic Principles for Rating of Electrical Machines and Apparatus. The last-named committee will first work on a revision of AIEE standard No. 1, General Principles Upon Which Temperature Limits Are Based in the Rating of Electrical Machinery and Apparatus, utilizing in part information and data contributed in papers and symposiums during the winter and summer conventions.

Table XI. Applications for Transfer

Year Ending April 30	Fellow Grade			Member Grade		
	Recommended	Not Recommended	Total	Recommended	Not Recommended	Total
1927	30	5	35	293	32	325
1928	21	3	24	280	17	297
1929	45	2	47	229	19	248
1930	28	2	30	211	29	240
1931	44	3	47	322	31	353
1932	7	2	9	149	17	166
1933	29	2	31	109	11	120
1934	25	2	27	154	3	157
1935	19	2	21	199	23	222
1936	27	1	28	205	24	229
1937	24	2	26	167	27	194
1938	26	0	26	137	7	144
1939	25	2	27	126	13	139
Totals	350	28	378	2,581	253	2,834

As a further means for increasing the interest of the membership in the standardization activities of the Institute, it has been decided to augment the columns of Electrical Engineering where brief reports on standards activities are given.

A plenary meeting of the International Electrotechnical Commission was held in Torquay, England, during the past year, at which 25 or more committees participated. A number of members of the Institute interested in standardization attended this meeting.

United States National Committee of the IEC

Nineteen-thirty-nine was an active year for the International Electrotechnical Commission. A very successful plenary meeting was held at Torquay, England, June 22 to July 1, this being the ninth plenary meeting. It was attended by 400 delegates from 22 countries, the United States being represented by 22 delegates.

Many important final decisions, as recorded in the brief reports below, were taken. Of outstanding importance was the recommendation of advisory committee 24 that the permeability of free space be the connecting link between the electrical and mechanical units of the Giorgi (MKS) System.

At the closing dinner to the delegates given by the British Standards Institution at the Guildhall, London, the Duke of Kent said:

The International Electrotechnical Commission's work in co-ordinating and simplifying industrial requirements in the electrical field should prove of the highest value to international exchange of electrical goods. This co-ordination should be increasingly valuable as the economic interdependence of the nations is more fully recognized.

A brief summary of some of the actions taken at the Torquay meeting is given below:

International Electrotechnical Vocabulary, IEC. 1. The first edition of the vocabulary, containing some 2,000 scientific and technical terms defined in both French and English, and with the titles in German, Spanish, Italian, and Esperanto, was approved for publication. About 150 copies have been distributed in this country.

Table XII. Applications for Admission and Transfer

Applications for Admission		
Recommended for grade of Associate	1,330	
Re-elected to the grade of Associate	86	
Not recommended	10	1,426
Recommended for grade of Member	95	
Re-elected to the grade of Member	11	
Not recommended	43	149
Recommended for grade of Fellow	1	
Re-elected to the grade of Fellow	—	
Not recommended	1	2
Applications for Transfer		
Recommended for grade of Member	126	
Not recommended	13	139
Recommended for grade of Fellow	25	
Not recommended	2	27
Students		
Recommended for enrollment as Students		2,079
Total		3,820

Transformers, IEC 2B. Two divergent methods of rating transformers have been in general use in different countries, one based on the full-load secondary current and the no-load secondary voltage, and the other based on the full-load secondary current and the full-load secondary voltage at a specified power factor (0.8 or 0.85). The IEC meeting at Torquay agreed that both the IEC test rating and the IEC service rating should be shown on the nameplate. It was also agreed that when no power factor is specified by the purchaser the service rating will be based on a power factor of 0.8, and that losses should be expressed in kilowatts and not as a percentage efficiency. Fractional loads are to be expressed in terms of current. The test rating agreed upon by the IEC as one of the factors to be used in rating transformers defines a transformer in which it might be desired to reverse the direction of flow of power, and the service rating defines a transformer with a predetermined direction of flow.

It was agreed that ambient temperature should be defined to mean that the peak value of 40 degrees centigrade should be associated with an average temperature not exceeding 35 degrees centigrade over any 24-hour period. The maximum temperature rise for oil-immersed transformers, with forced oil circulation, it was agreed, should be 65 degrees centigrade.

Graphical Symbols, IEC 3. IEC Publication 42, graphical symbols for heavy current systems, will be revised on the basis of decisions taken at Torquay. Publication 42, graphical symbols for weak current systems, will be submitted to the national committees for approval of the revision agreed to at Torquay.

Steam Turbines, IEC 5. Two IEC publications (45 and 46) were extended to cover all other kinds of turbines not heretofore covered. Certain decisions were also taken on fluid flow measurement.

Lamp Caps and Holders, IEC 6. Dimensions of lamp caps and holders, approved by this committee, will be published by the IEC. Drawings of gages were approved, but each National Committee will, of course, decide for itself what gages would be used for checking the dimensions.

Aluminum, IEC 7. It was unanimously agreed that annealed aluminum should be defined as aluminum which, in the form of wire of 1 mm diameter and greater, has a maximum tensile strength of 9.5 kg per square mm and a minimum elongation of 20 per cent in a length of 200 mm. The measurement of the elongation is to be taken after fracture. The normal resistivity value should be 0.0278 ohm mm^2/m at a temperature of 20 degrees centigrade. The temperature coefficient and density for hard-drawn aluminum are considered the same as for annealed aluminum. For the steel core it was agreed to adopt a minimum tensile strength of 120 kg/mm^2 and an elongation of 5 per cent for wires of 3 mm diameter and over, and 4 per cent for wires which are smaller than 3 mm diameter. Standards of resistivity for aluminum used for insulated cables and bus bars were agreed upon.

Standard Voltages and High Voltage Insulators, IEC 8. A column showing the three-phase phase-voltages corresponding to the three-phase phase-to-neutral voltages will be included in the new edition of the IEC publication on Standard Voltages, in the section on voltage between 100 and 1,000 volts. The first edition of an international specification on the testing of insulators will be issued, it was agreed. Impulse voltage tests for the testing of line insulators will be included.

The meeting referred a draft specification for testing wall bushing insulators to the national committees for consideration, and approved a report recommending the revision of the IEC calibration tables for sphere gaps.

Electric Traction Equipment, IEC 9. A revised edition of the specification for traction motors will be circulated to the national committees for approval.

Overhead Lines, IEC 11. A new edition, in French, of Publication No. 49, comparison of the regulations in force in various countries for the erection of overhead lines, has been prepared. Further consideration will be given to formulas proposed for the calculation of the loading of overhead lines.

Electrical Instruments, IEC 13. Revision of the publications on alternating current watt-hour meters; instrument transformers; and indicating instruments was discussed, and action will be taken later. This committee held a joint meeting with the advisory committee on terminal markings, and the two committees appointed a subcommittee to consider marking instrument transformers separately from instruments and meters.

Terminal Markings, IEC 16. A report by this committee summarized the systems of terminal markings now in use as follows:

(*a*). The system used in the United States as given in the American Standard for rotation, connections, and terminal markings for electric power apparatus.

(*b*). The system used in Great Britain which will be available soon as a report of the British Standards Institution.

(*c*). A composite system taking certain of its parts from the systems of the different nations on the continent of Europe, the composite being arrived at in discussions in IEC Advisory Committee Number 16.

It is expected that the IEC will print the composite system as a report in the hope that as the various nations find it necessary to change their existing systems they will be able to adopt this system in whole or in part.

The IEC will also publish a separate report giving the history of the whole situation on terminal markings, explaining the three separate systems and giving information as to where detailed information on all of them may be obtained.

Switchgear, IEC 17. Insulation tests, impulse voltage tests, the natural frequency of the test circuit and the rate-of-rise of recovery voltage and the testing of large circuit breakers were discussed.

Electric Cables, IEC 20. A revision of the IEC specifications was suggested and proposed changes were submitted to a subcommittee for consideration.

Electric and Magnetic Magnitudes and Units, IEC 24. It was agreed that the committee recommend that the connecting link between the electrical and mechanical units in the MKS system should be the permeability of free space (μ_0) with the value of 10^{-7} in the unrationalized system, $4\Pi 10^{-7}$ in the rationalized system. The committee also agreed to recommend that the name of the unit of force should be the "Newton."

Letter Symbols, IEC 25. A revised edition of IEC publication 27 will be circulated to the national committees for approval.

Electric Welding, IEC 26. The first meeting of this committee decided that it will start its program with work on welding plant and equipment, and that it will co-operate with the committee on welding of the International Standards Association. Definitions, rating of welding plant and equipment, non-automatic single-arc direct-current welding sets, automatic single-arc direct-current welding sets, constant-voltage multiple-arc direct-current welding sets, electric motors, air-cooled direct-current reactors, and chokes and transformers were discussed. Proposals made by the British committee will be reviewed and referred to the various national committees for their recommendations.

More detailed reports of all committee meetings are available. Anyone interested should write to J. W. McNair, secretary of the U.S. national committee of the International Electrotechnical Commission, American Standards Association, 29 West 39th Street, New York.

It is now expected that meetings of the following IEC advisory committees will be held in New York, September 5–8, 1939.

2b Transformers
4 Hydraulic Turbines
17 Switchgear
19 Internal Combustion Engines
26 Welding

The organization meeting of the new committee on insulation co-ordination and possibly the subcommittee on sphere gaps.

Committee on Planning and Co-ordination

The recommendation of the predecessor, the committee on co-ordination of Institute activities, that the committee be reconstituted under the title "committee on planning and co-ordination" and assume the broader duties thus indicated was approved by the board of directors, with the change effective August 1, 1938. Section 70 of the bylaws was amended to assign to the committee the additional duty of giving continuous attention to the planning of Institute activities of the future.

The committee invited a considerable group of members to supply their views on the present activities of the Institute and their suggestions regarding any changes or additions which would make the organization more valuable to the profession in general and its members in particular.

A comprehensive report on present and proposed future activities of the Institute, based very largely on the 29 replies received and the views of members of the committee, has been submitted for consideration of the board of directors at its May meeting.

In accordance with past practice, the committee received requests from District and Section officers for national conventions and District meetings desired in their Districts in 1940, and submitted a recommended schedule of such meetings, which was approved by the board of directors in January.

Institute Policy Committee

The only matter referred to the committee during the year was the question as to

whether the Institute should include in its scope of activity consideration of an engineering approach to the physical facts of depreciation and obsolescence of electrical material.

The AIEE executive committee requested the Institute policy committee to submit an outline of the principal factors, both for and against participation in this field, that should be considered by the board of directors.

Committee on Safety

By an action of the board of directors the functions of the committee on safety codes were expanded, and a committee on safety created to include the entire field of safety in electrical engineering.

The committee, in letters, has endeavored to interest universities, and in particular their electrical engineering departments, in the matter of accident prevention and including instruction in the proper method of resuscitation from electric shock, asphyxiation, drowning, et cetera. Suggestions have been included that other departments of the universities may also be interested in the subject, with emphasis on instruction to all students, particularly because of the frequent occurrence of such accidents outside of university laboratories. Such training among the electric and gas utility companies has, over the years, resulted in the saving of the lives of many persons who have accidentally come in contact with energized parts, or apparently have been drowned, or asphyxiated from gas fumes. The committee is convinced that continual training in this method is absolutely essential and that, to be most effective, such training should be given before students have left the universities. Letters were therefore sent to 120 professors of electrical engineering of the various universities and colleges, together with a booklet describing the Schafer Prone Pressure Method of Resuscitation. The replies were immediate and evidenced a highly co-operative spirit. Correspondence is continuing with such universities.

Letters were also sent by the committee to the counselors of student branches of the universities, requesting that during the year each student branch arrange to have presented before the branch a paper dealing with some phase of the problem of prevention of accidents or remedial measures after electrical shock. This had been discussed with the chairman of the committee on student branches and received his wholehearted endorsement. Assistance was offered, if necessary, to secure a local speaker to prepare and present such a paper. Again the reaction was spontaneous, and steps have been inaugurated to attain this during this or the coming year, where this subject had not already been included in the meetings.

A similar letter was authorized to be sent to the various Sections of the Institute to recommend to them that during each year they arrange to have presented before each Section a paper dealing with the prevention of accidents or remedial measures after electrical shock. It was found that, in general, arrangements were being made by the Sections to include this important subject in their programs.

There exists a great need for the distribution of a comprehensive booklet on resuscitation, of convenient size, which people could readily obtain for reference.

A movement has been started to obtain information relating to safety practices from all related foreign institutes of various kinds. Abstracts are being prepared of replies received, and it is hoped that a comprehensive summary of practices will be available soon.

The committee was successful early in the year in arranging for the preparation of a paper for a general meeting. The paper now under preparation is concerned with safe practices in college laboratories, dealing largely with methods to assure safety to the laboratory students and personnel. Arrangements have been made for the preliminary presentation of this paper at a meeting of the Society for the Promotion of Engineering Education.

During the year, a number of subjects relating to electrical safety were presented for discussion. It was found that such subjects being given active consideration were concerned with the developments in, or revision of, electrical codes or standards in general sponsored under the auspices of the American Standards Association. Some of the subjects, from a purely technical viewpoint, are being given further consideration.

The committee is of the opinion that the time to make apparatus safe for construction, operation, and maintenance is at the time that the apparatus is being designed. It has therefore recommended to the National Electrical Manufacturers Association that they request their members to add a line on the original drawings to provide that the design be checked for safety in the engineering department or drafting office. This recommendation might well be also carried out by manufacturers and public utilities generally.

Committee on Legislation Affecting the Engineering Profession

The committee on legislation affecting the engineering profession, consisting of fifteen members well representative of all of the Sections, has carried on its work along the lines similar to those of previous years.

Some thought has been given to possible methods which might enable the committee to keep in touch with proposed legislation regarding licensing of engineers that may be introduced in the various state legislatures so that the Institute could be promptly and properly informed regarding those developments with a view toward being helpful.

The Texas registration law was contested during the year in the courts, and, upon the request of the national secretary, all of the pertinent information available at the time in connection with the case was obtained from the secretary of the Texas State board and the dean of engineering of the University of Texas and forwarded to the Institute. The principal controversial point in this case hinged upon the definition of "principles of engineering" used in the Texas law, and upon final disposition of this matter a report will be made to the national secretary of the Institute.

Committee on Code of Principles of Professional Conduct

Members of this committee have each been provided with a copy of the codes of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Chemical Engineers, the American Institute of Consulting Engineers, and the American Association of Engineers in addition to our own code, and have considered whether our code required modification. No suggestions have come forth proposing modifications, and it therefore may be interpreted that none is necessary at the present time.

Committee on Constitution and Bylaws

This committee considered and recommended several proposed amendments to the bylaws of the Institute. The committee conducted its work by correspondence.

Committee on Economic Status of the Engineer

Members of the committee met informally at the winter convention. In the matters of employment, unemployment security, and annual income there are available the publication of bulletins No. R-497, 543, 588, and 631 by the United States Department of Labor covering the engineering profession, 1929–34, Professor Sorensen's paper on the Economic Status of the Engineer, Transactions, 1938, and a bulletin of the National Bureau of Economic Research, February 1939, comparing engineers' income with that of other professions. The committee feels, therefore, that adequate data on that phase of its assignment have been presented.

The committee is observing the progress of the ECPD committee on professional recognition, and has noted its recent study of the qualification procedure in the fields of accounting, architecture, law, and medicine. The committee is watching the policies and organization plans of other professional engineering societies and federations of engineers, and the trend of possible reorganization and revision of the objectives of the American Engineering Council.

Committee on Award of Institute Prizes

Three national and 12 District prizes were awarded in 1938 for papers presented in the calendar year 1937 and for student papers presented during the academic year ending June 30, 1938. These awards were announced in the issues of Electrical Engineering for July, September, and December 1938 and April 1939.

The committee considered a large number of papers and the gradings and recommendations of the technical committees which had reviewed the papers. Many papers considered were of a high quality, and, in addition to the national prizes, ten other papers were given honorable mention.

Committee on Award of Columbia University Scholarships

During February and March 1938, there were twelve applications for the Columbia University scholarship. After due consideration of the merits of all the applicants, the committee voted to award the scholarship for 1938–39 to Mr. James E. Hulsizer, who received his B.S. degree from Princeton in June 1938. Mr. Hulsizer accepted the

scholarship, and has been in regular attendance during the present academic year.

Edison Medal

The Edison Medal, which is awarded by a committee composed of 24 members of the Institute, was, for 1938, awarded to Dr. Dugald C. Jackson "for outstanding and inspiring leadership in engineering education and in the fields of generation and distribution of electric power," and was presented on January 25, 1939, during the winter convention. The medal may be awarded annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts."

John Fritz Medal

The John Fritz Medal board of award, composed of representatives of the national societies of civil, mining, mechanical, and electrical engineers, awarded the 35th medal (for 1939) to Dr. Frank B. Jewett, vice-president, American Telephone & Telegraph Company, and president, Bell Telephone Laboratories, Inc., for "vision and leadership in science, and for notable achievement in the furtherance of industrial research and development in communication."

Lamme Medal

The Lamme Medal committee awarded the medal for 1938 to Marion A. Savage, designing engineer, General Electric Company, "for able and original work in the development and improvement of mechanical construction and the efficiency of large high speed turbine alternators." Arrangements are being made for the presentation of the medal at the combined Summer and Pacific Coast convention in San Francisco, Calif., June 26–30, 1939. The medal may be awarded annually to a member of the AIEE "who has shown meritorious achievement in the development of electrical apparatus or machinery."

Alfred Noble Prize

This prize, established in 1929, consists of a certificate and a cash award of $500 from the income from a fund contributed by engineers and others to perpetuate the name and achievements of Alfred Noble, past-president of the American Society of Civil Engineers and of the Western Society of Engineers. It may be made to a member of any of the co-operating societies, ASCE, AIME, ASME, AIEE, or WSE, for a technical paper of particular merit accepted by the publication committee of any of these societies, provided the author, at the time of such acceptance, is not over 30 years of age. The award for 1938 was presented to Ralph J. Schilthuis for his paper on "Connate Water in Oil and Gas Sands."

Washington Award

The Washington Award for 1939 was bestowed upon Dr. Daniel Webster Mead, "for his superior contribution to sound theory, good practice, and high ethical standards in the creation of engineering works as an engineer and as a teacher," and was presented to him at a dinner on February 20, 1939. This award may be made annually to an engineer by the commission of award composed of nine representatives of the Western Society of Engineers and two each of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, and AIEE.

Hoover Medal

The Hoover Medal was established through a trust fund created by a gift from Conrad N. Lauer, and is to be awarded periodically "to a fellow engineer for distinguished public service" by a board representing the national societies of civil, mining and metallurgical, mechanical, and electrical engineers. The third recipient of this medal was John Frank Stevens, who was cited as an "engineer of great achievement, as illustrated in his work on the Panama Canal, who, in his dealings with the inter-allied forces in Siberia in the Great War, demonstrated those broader capacities for humanitarian public service beyond his calling."

Iwadare Foundation Committee

No Iwadare lecturer was chosen to go to Japan for the current year, nor has any Iwadare Fellow come to the United States.

Employment Service

The Institute co-operates with the national societies of civil, mining, and mechanical engineers in the operation of the Engineering Societies Employment Service with its main office in the Engineering Societies Building, New York. Offices are operated in Chicago and San Francisco also. In addition to the societies named, others co-operate in certain of the offices as follows: New York—Society of Naval Architects and Marine Engineers; Chicago—Western Society of Engineers; San Francisco—California Section of the American Chemical Society; and the Engineers' Club of San Francisco.

The service is supported by the joint contributions of the societies and their individual members who are benefited. In addition to the publication of the employment service announcements monthly in Electrical Engineering, weekly subscription bulletins are issued for those seeking positions.

An analysis of this employment service as reported to the national societies is given in table XIII.

American Engineering Council

The American Engineering Council has continued to carry on a wide range of activities within the scope of its objectives: "to further the public welfare wherever technical and engineering knowledge and experience are involved, and to consider and act upon matters of common concern to the engineering and allied technical professions."

The 19th annual meeting of the assembly was held in Washington, D. C., January 12–14, 1939. The 9th conference of engineering society secretaries was held on the 12th.

During 1938, the Council sponsored two forums which were held with the co-operation of local organizations of engineers, the first in Philadelphia, May 13, on the subject "Employment and the Engineer's Relation to It," and the second in Detroit, November 11, on "Invention and the Engineer's Relation to It." On account of the success of these two meetings, the annual meeting was planned as a series of forums on the following subjects, suggested by the work of several of the Council's committees:

1. National Planning and the Engineer's Relation to It.
2. The Economic Status of the Engineering and Kindred Professions.
3. Engineering Aspects of Government Reorganization.
4. Engineering and Economic Factors in the Size of Business.

At the all-engineers dinner, Dr. Vannevar Bush, president of the Carnegie Institution of Washington, and a director of the AIEE, delivered an address on "The Qualities of a Profession," which was published in the April 1939 issue of Electrical Engineering, pages 156–60.

The business session was devoted to consideration of committee reports and other matters, as well as the financial status of the Council. It was reported that the National Industrial Conference Board had

Table XIII. Analysis of Employment Service

Month	Men Registered				Men Placed			
	New York	Chicago	San Francisco	Total	New York	Chicago	San Francisco	Total
1938								
May	258	135	106	499	34	18	23	75
June	289	169	97	555	55	12	7	74
July	188	98	86	372	28	20	33	81
August	181	86	80	347	47	33	28	108
September	199	99	50	348	50	23	21	94
October	175	67	79	321	57	23	26	106
November	133	58	51	242	45	30	13	88
December	102	46	79	227	37	13	17	67
1939								
January	144	37	73	254	53	16	23	92
February	143	62	85	290	40	16	12	68
March	169	67	109	345	51	19	19	89
April	140	96	91	327	46	21	16	83
Total	2,121	1,020	986	4,127	543	244	238	1,025

recently granted $22,500 for the conduct of a special study under the direction of the Council's subcommittee on patents.

United Engineering Trustees, Inc.

This organization is the corporate body which holds title in the name of the four Founder Societies to their joint physical properties, namely, the Engineering Societies Building, the Engineering Societies Library, and the endowment funds of The Engineering Foundation. It operates and manages the Engineering Societies Building and administers certain joint activities of the four Founder Societies.

The annual report of the UET for the year which ended September 30, 1938, showed practically full occupancy of the building, gratifying use of meeting halls, and a stable financial situation.

An abstract of the report was published in Electrical Engineering for December 1938, pages 518–19.

Engineering Foundation

The Engineering Foundation is a joint organization of the national societies of civil, mining and metallurgical, mechanical, and electrical engineers established for "the furtherance of research in science and engineering, and the advancement in any other manner of the profession of engineering and the good of mankind."

The Foundation's funds were augmented by a bequest from the late Ambrose Swasey of $86,977.16, this being the fifth of his gifts to the Foundation. The total book value of the Foundation fund is now $957,698.

The Foundation has been assisting in a wide range of technical researches sponsored by the founder societies. Some of the principal groups now in progress are: ASCE—soil mechanics and foundations, hydraulics; AIME—alloys of iron, barodynamic problems; ASME—critical pressure steam boilers, fluid meters, lubrication, cottonseed processing, rolling steels; AIEE—stability of impregnated paper insulation; AIEE and AWS—welding; University of California—plastic flow of concrete; New York University—wind direction and velocity.

Assistance in non-technical matters related to engineering has been granted to the Engineers' Council for Professional Development and the Personnel Research Federation.

An abstract of the annual report of the Engineering Foundation for the year which ended September 30, 1938, was published in the December 1938 issue of Electrical Engineering, pages 519–21.

Engineering Societies Library

The Engineering Societies Library, which was formed by combining the separate libraries of the four national societies of civil, mining and metallurgical, mechanical, and electrical engineers, and the preparation of a composite card catalog, has been expanded as a single engineering library, which probably constitutes the best collection of its type in the United States.

On September 30, 1938, the library had 144,262 volumes, 7,408 maps, 4,391 bibliographies. Books, pamphlets, and maps totaling 14,041 were received during the year ending at that time. Current issues of 1,369 periodicals were received. Work progressed rapidly on a classified index to periodicals, and the index now contains more than 225,000 references to articles published since 1927.

Special services rendered by the library include: photoprints, searches, abstracts, translations, bibliographies, book loans by mail, etc. An abstract of the annual report of the library appeared on page 519 of Electrical Engineering for December 1938.

Engineers' Council for Professional Development

This council was organized in 1932 to engage in activities leading to the enhancement of the professional status of the engineer. It includes three representatives of each of the seven participating organizations: the national societies of chemical, civil, electrical, mechanical, and mining and metallurgical engineers, the Society for the Promotion of Engineering Education, and the National Council of State Boards of Engineering Examiners.

The principal activities of ECPD include programs for the guidance of young individuals thinking of entering the engineering field, the accrediting of curricula of engineering schools, encouragement and assistance to individuals in their engineering and cultural studies during several years after graduation, and the development of criteria for indicating the attainment of the status of an engineer.

At the annual meeting held on October 22, 1938, the committee on engineering schools submitted recommendations on 63 additional curricula, bringing the total number to 679 curricula in 136 institutions. Of these, 392 were accredited, 107 were accredited provisionally, 179 were not accredited, and action on one was deferred. The complete list of curricula thus far accredited appeared in the December 1938 issue of Electrical Engineering, page 514.

Comprehensive information regarding other committee reports and the various other matters considered and acted upon at the annual meeting appeared in the same issue, pages 513–16.

Representatives

The Institute has continued its representation upon many joint committees and national bodies, with which it co-operates in a wide range of activities of interest and importance to engineers and others.

A list of representatives was published in the September 1938 issue of Electrical Engineering and in the 1939 Year Book.

Finance Committee

The committee, as usual, recommended a detailed budget to the board of directors, passed upon the expenditures for various purposes, made recommendations regarding delinquent members, and performed the other duties prescribed for it in the constitution and by-laws.

Haskins and Sells, certified public accountants, have audited the books, and their report follows.

The board of directors extends to the national committees, and the District, Section, and Branch officers its deep appreciation of their continuing effective services, which have produced a high degree of activity, enthusiasm, and constructive accomplishment in all phases of Institute work. The board of directors has been much encouraged by the generous support which the members have given its efforts on their behalf.

Respectfully submitted for the board of directors.

H. H. Henline,
National Secretary

May 26, 1939

HASKINS & SELLS
CERTIFIED PUBLIC ACCOUNTANTS

22 EAST 40TH STREET
NEW YORK

May 18, 1939

American Institute of Electrical Engineers,
33 West 39th Street, New York.

Dear Sirs:

We have made an examination of your balance sheet as of April 30, 1939, and of your recorded cash receipts and disbursements for the year ended that date. In connection therewith, we examined or tested your accounting records and other supporting evidence in a manner and to the extent which we considered appropriate in view of your system of internal accounting control. We present the following financial statements:

Balance Sheet, April 30, 1939 (Exhibit A).
Property and Restricted Funds Securities, Less Reserve for Securities of Doubtful Value (Schedule 1).

Statement of Recorded Cash Receipts and Disbursements of General Fund for the Year Ended April 30, 1939 (Exhibit B).

Statement of Recorded Cash Receipts and Disbursements of Property and Restricted Funds for the Year Ended April 30, 1939 (Exhibit C).

In accordance with the terms of our engagement, members and other debtors were not requested to confirm to us the amounts receivable from them at April 30, 1939, and, in accordance with the usual practice of the Institute, no provision has been made for dues which may prove to be uncollectible.

In our opinion, based upon such examination and subject to the comments in the next preceding paragraph, the accompanying Exhibit A fairly presents your financial condition at April 30, 1939, and the accompanying Exhibits B and C fairly present your recorded cash receipts and your disbursements of funds, as indicated, for the year ended that date.

Yours truly,

Haskins & Sells

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Exhibit A — Balance Sheet, April 30, 1939

ASSETS			LIABILITIES		
Property Fund Investments:			**Property Fund Reserve**		$554,209.58
One-fourth interest in real estate and other assets of United Engineering Trustees, Inc., exclusive of trust funds	$498,448.48		**Restricted Fund Reserves:**		
Equipment:			Reserve Capital Fund	$191,634.04	
Library—volumes and fixtures	37,296.37		Life Membership Fund	9,168.34	
Office furniture and fixtures (less reserve for depreciation, $29,255.45)	5,398.38		International Electrical Congress of St. Louis Library Fund	5,521.17	
Works of art, etc	3,001.35		Lamme Medal Fund	4,514.73	
Securities—at cost (market quotation value, $9,597.17)—Schedule 1	10,032.17		Mailloux Fund	1,040.23	
Cash (see Exhibit C)	32.83		Total restricted fund reserves		211,878.51
Total property fund investments		$554,209.58	**Current Liabilities—Accounts payable**		11,423.26
Restricted Fund Investments:			**Deferred Income:**		
Securities—at cost, less reserve for securities of doubtful value (Market quotation value, $178,881.07)—Schedule 1	$195,994.82		Dues received in advance	$ 3,792.27	
Cash (see Exhibit C)	15,738.53		Entrance fees and dues advanced by applicants for memberships	539.66	
Accrued interest receivable	145.16		Deferred credits and other unallocated receipts	428.32	
Total restricted fund investments		211,878.51	Subscriptions for TRANSACTIONS received in advance	8.27	
Current Assets:			Reserve for prepaid subscriptions for ELECTRICAL ENGINEERING	8,700.00	
Cash (see Exhibit B)	$ 61,988.30		Total deferred income		13,468.52
Accounts receivable:			**Surplus**		72,899.60
Members—for dues	19,733.35				
Advertisers	389.25				
Miscellaneous	2,419.80				
Accrued interest on investments	1,733.97				
Inventories:					
TRANSACTIONS, etc	1,984.00				
Text and cover paper	5,560.65				
Work in process (May issue of ELECTRICAL ENGINEERING)	3,061.14				
Badges	920.92				
Total current assets		97,791.38			
Total		$863,879.47	**Total**		$863,879.47

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Property and Restricted Funds Securities, Less Reserve for Securities of Doubtful Value, April 30, 1939

Exhibit A, Schedule 1

	Face Value of Bonds or Number of Shares of Stock	Property Fund (Equipment Replacements)	Restricted Funds					
			Reserve Capital Fund	Life Membership Fund	International Electrical Congress of St. Louis Library Fund	Lamme Medal Fund	Mailloux Fund	Total
Railroad Bonds:								
Alleghany Corporation 20-year collateral trust convertible 5%, due 1949	$15,000.00		$ 10,627.50					$ 10,627.50
Baltimore & Ohio Railroad Company 6% refunding and general mortgage series C, due 1995 (certificates of deposit)	12,000.00		8,940.00			$4,330.00		13,270.00
Central of Georgia Railway Company 5% consolidated mortgage, due 1945	3,000.00		1,477.50					1,477.50
Chicago, Burlington & Quincy Railroad Company 5% first and refunding mortgage series A, due 1971	1,000.00		1,010.00					1,010.00
Chicago & Erie Railroad Company 5% first mortgage, due 1982	1,000.00		1,105.00					1,105.00
Chicago & Northwestern Railway Company 6½%, due March 1, 1936	9,000.00		7,202.50					7,202.50
Cleveland Union Terminals Company 5% sinking fund series B, due 1973	4,000.00	$ 4,010.00						
Florida East Coast Railway Company 5% first and refunding mortgage series A, due 1974 (certificates of deposit)	10,000.00		9,818.75					9,818.75
New York Central Railroad Company 5% refunding and improvement mortgage series C, due 2013	6,000.00		5,742.50					5,742.50
Northern Pacific Railway Company 6% refunding and improvement mortgage series B, due 2047	10,000.00		10,962.50					10,962.50
Pennsylvania Railroad Company 30-year secured serial 4%, due 1944	6,000.00		5,337.50		$1,067.50			6,405.00
St. Louis-San Francisco Railway Company 5% prior lien mortgage series B, due 1950 (certificates of deposit)	6,000.00		5,497.50					5,497.50
Southern Pacific Company Oregon Lines 4½% first mortgage series A, due 1977	1,000.00				996.25			996.25
Texas and Pacific Railway Company general and refunding series B 5%, due 1977	5,000.00			$5,306.25				5,306.25
Western Pacific Railroad Company 5% series A, due 1946 (stamped)	15,000.00		7,225.00					7,225.00
Total railroad bonds—(FORWARD)		$ 4,010.00	$ 74,946.25	$5,306.25	$2,063.75	$4,330.00		$ 86,646.25

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Property and Restricted Funds Securities, Less Reserve for Securities of Doubtful Value, April 30, 1939

Exhibit A, Schedule 1 (Concluded)

	Face Value of Bonds or Number of Shares of Stock	Property Fund (Equipment Replacements)	Restricted Funds					
			Reserve Capital Fund	Life Membership Fund	International Electrical Congress of St. Louis Library Fund	Lamme Medal Fund	Mailloux Fund	Total
Total Railroad Bonds—FORWARD		$ 4,010.00	$ 74,946.25	$5,306.25	$2,063.75	$4,330.00		$ 86,646.25
Public Utility Bonds:								
American Gas & Electric Company 5% debenture, due 2028	6,000.00		$ 6,397.50					$ 6,397.50
Monongahela-West Pennsylvania Public Service Company 6% debentures, due 1965	8,000.00		8,660.00					8,660.00
New York Telephone Company first and general mortgage 4½%, due 1939	1,000.00						$1,000.00	1,000.00
Total public utility bonds			$ 15,057.50				$1,000.00	$ 16,057.50
Industrial and Miscellaneous Bonds, Etc.:								
Fidelity Union Title and Mortgage Guaranty Company first mortgage certificates (on property 75–79 Prospect Street, East Orange, N. J.), 4%, due 1944	$14,507.49	$ 967.17	$ 13,540.32					$ 13,540.32
General Motors Acceptance Corporation 3¼%, due 1951	7,000.00		7,140.00					7,140.00
United States Steel Corporation debentures 3¼%, due 1948	8,000.00		8,240.00					8,240.00
Total industrial and miscellaneous bonds, etc		$ 967.17	$ 28,920.32					$ 28,920.32
Municipal Bonds—New York City 4½% corporate stock, due 1957	2,000.00				$2,204.05			$ 2,204.05
United States Government Bonds and Notes:								
Federal Farm Mortgage 3%, due 1949/44	12,000.00		$ 12,405.00					$ 12,405.00
Treasury Bonds 3¼%, due 1941	10,000.00		10,650.00					10,650.00
Treasury Bonds 2¾%, due 1947/45	10,000.00		10,409.38					10,409.38
Treasury Bonds 3⅜%, due 1943/40	10,000.00		10,537.50					10,537.50
Treasury Bonds 3¼%, due 1942/41	10,000.00		10,681.25					10,681.25
Treasury Notes 2% series B, due September 15, 1942	21,000.00		21,756.57					21,756.57
Total United States Government bonds and notes			$ 76,439.70					$ 76,439.70
Capital Stocks:								
Commonwealth Edison Company	48 shares		$ 2,892.00					$ 2,892.00
Commercial Investment Trust Corporation 4¼% preferred, series of 1935	100 "		10,100.00					10,100.00
Consolidated Edison Company of New York, Inc. $5.00 cumulative preferred	30 "	$ 3,060.00						
International Match Realization Co., Ltd. voting trust certificates for capital shares of International Match Corporation	6 "		2,274.15					2,274.15
Public Service Corporation of New Jersey $5.00 preferred	30 "		2,958.75					2,958.75
United Gas Improvement Company $5.00 preferred	30 "	1,995.00	997.50					997.50
Total capital stocks		$ 5,055.00	$ 19,222.40					$ 19,222.40
Total		$10,032.17	$214,586.17	$5,306.25	$4,267.80	$4,330.00	$1,000.00	$229,490.22
Less Reserve for Securities of Doubtful Value:								
Central of Georgia Railway Company 5% consolidated mortgage, due 1945	$ 3,000.00		$ 1,477.50					$ 1,477.50
Chicago & Northwestern Railway Company 6½%, due March 1, 1936	9,000.00		7,202.50					7,202.50
Florida East Coast Railway Company 5% first and refunding mortgage series A, due 1974	10,000.00		9,818.75					9,818.75
International Match Realization Company, Ltd. voting trust certificates for capital shares of International March Corporation	6 shares		2,274.15					2,274.15
St. Louis-San Francisco Railway Company 5% prior lien mortgage series B, due 1950	$ 6,000.00		5,497.50					5,497.50
Western Pacific Railroad Company 5% series A, due 1946 (stamped)	15,000.00		7,225.00					7,225.00
Total reserve for securities of doubtful value			$ 33,495.40					$ 33,495.40
Total Securities, Less Reserve		$10,032.17	$181,090.77	$5,306.25	$4,267.80	$4,330.00	$1,000.00	$195,994.82
Total Property Fund Securities		$10,032.17						
Total Restricted Funds Securities			$181,090.77	$5,306.25	$4,267.80	$4,330.00	$1,000.00	$195,994.82

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Statement of Recorded Cash Receipts and Disbursements of General Fund for the Year Ended April 30, 1939

Exhibit B

Cash on Deposit With The National City Bank of New York, May 1, 1938		$ 49,616.89
Receipts:		
Dues (including $86,226.00 allocated to ELECTRICAL ENGINEERING subscriptions)	$191,719.44	
Advertising	26,360.83	
TRANSACTIONS subscriptions	8,262.45	
ELECTRICAL ENGINEERING subscriptions	14,990.85	
Miscellaneous publications (preprints, standards, etc.)	8,912.95	
Student fees	11,297.50	
Entrance fees	7,023.70	
Membership badges	1,808.40	
Transfer fees	770.00	
Interest on investments, less purchased interest	8,981.91	
Miscellaneous	16.90	
Total receipts		280,144.93
Total		$329,761.82
Disbursements:		
Publication expense:		
ELECTRICAL ENGINEERING	$ 72,893.80	
TRANSACTIONS	8,843.13	
YEAR BOOK	6,567.96	
Miscellaneous publications (preprints, standards, etc.)	12,323.68	
Institute meetings	13,623.38	
Institute Sections	33,853.28	
Institute Branches	3,265.05	
Edison Medal committee	299.11	
Finance committee	1,600.00	
Headquarters committee	34.75	
Membership committee	8,082.47	
Standards committee	6,413.15	
Technical committee	286.41	
Traveling expenses:		
Geographical Districts:		
Executive committees	2,899.85	
Vice-presidents	365.79	
Branch counselors	8,036.08	
President's appropriation	34.85	
Board of directors	3,274.22	
National nominating committee	1,020.79	
Forward	$183,717.75	$329,761.82
Total—(Forward)		$329,761.82
Disbursements—(Forward)	$183,717.75	
Administrative expenses	46,221 53	
Geographical Districts—best paper prizes	185.50	
Geographical Districts—initial paper prizes	85.50	
Institute prizes	109.00	
American Engineering Council	10,500.00	
American Standards Association	1,500.00	
United Engineering Trustees, Inc.:		
Building assessment	10,984.80	
Library assessment	9,689.28	
Engineering Societies Employment Service	1,512.77	
Engineers' Council for Professional Development	435.00	
Engineering Foundation Projects:		
Welding research	250.00	
Research on impregnated paper insulation	250.00	
John Fritz Medal	201.92	
National Fire Protection Association—dues	60.00	
United States Committee of International Commission on Illumination	300.00	
Membership badges	1,503.97	
Legal services	250.00	
Miscellaneous	16.50	
Total disbursements		267,773.52
Cash on Deposit With The National City Bank of New York, April 30, 1939		$ 61 988.30

Statement of Recorded Cash Receipts and Disbursements of Property and Restricted Funds for the Year Ended April 30, 1939

Exhibit C

	Property Fund (Equipment Replacements)	Restricted Funds: Reserve Capital Fund	Life Membership Fund	International Electrical Congress of St. Louis Library Fund	Lamme Medal Fund	Mailloux Fund	Total Restricted Funds
Cash on Deposit With East River Savings Bank and The National City Bank of New York, May 1, 1938	$22.47	$ 82.06	$3,794.44	$1,024.19	$148.03	$22.23	$ 5,070.95
Receipts:							
Interest on bonds, and dividends on stocks			$ 250.00	$ 175.00	$240.00	$45.00	$ 710.00
Interest on bank balance			73.66				73.66
Proceeds from sale and redemption of securities	$10.36	$53,639.03					53,639.03
Life membership fee			288.51				288.51
Total receipts	$10.36	$53,639.03	$ 612.17	$ 175.00	$240.00	$45.00	$54,711.20
Total	$32.83	$53,721.09	$4,406.61	$1,199.19	$388.03	$67.23	$59,782.15
Disbursements:							
Annual withdrawal authorized in by-laws			$ 565.35				$ 565.35
Gold and bronze replicas of Lamme Medal and certificate					$239.30		239.30
Purchase of securities		$43,177.82					43,177.82
All other disbursements				$ 11.65		$49.50	61.15
Total disbursements		$43,177.82	$ 565.35	$ 11.65	$239.30	$49.50	$44,043.62
Balance on Deposit With East River Savings Bank and The National City Bank of New York, April 30, 1939	$32.83	$10,543.27	$3,841.26	$1,187.54	$148.73	$17.73	$15,738.53

New Officers of ASTM. Newly elected officers of the American Society for Testing Materials have been announced as follows: *president* (1939–40)—H. H. Morgan, manager rail and track fastenings department, Robert W. Hunt Company, Chicago, Ill.; *vice-president* (1939–41)—G. E. F. Lundell, chief of chemistry division, National Bureau of Standards, Washington, D. C.; *members of executive committee* (1939–41)—J. J. Allen, chief chemist, mechanical rubber goods division, Firestone Tire and Rubber Company, Akron, Ohio; R. D. Bonney, assistant manager of manufacturing, Congoleum-Nairn, Inc., Kearny, N. J.; T. S. Fuller, engineer of materials, General Electric Company, Schenectady, N. Y.; J. L. McCloud, metallurgical chemist, Ford Motor Company, Dearborn, Mich.; M. A. Swayze, director of research, Lone Star Cement Company, Hudson, N. Y.

ASTM Awards Dudley Medal. The American Society for Testing Materials has awarded the Charles B. Dudley Medal for 1938 to R. W. Carlson, associate professor of civil engineering, Massachusetts Institute of Technology, Cambridge, for his paper "Dry Shrinkage of Concrete as Affected by Many Factors." The medal is awarded for a paper of outstanding merit constituting an original contribution to research.

Letters to the Editor

CONTRIBUTIONS to these columns are invited from Institute members and subscribers. They should be concise and may deal with technical papers, articles published in previous issues, or other subjects of some general interest and professional importance. ELECTRICAL ENGINEERING will endeavor to publish as many letters as possible, but of necessity reserves the right to publish them in whole or in part, or reject them entirely.

ALL letters submitted for consideration should be the original typewritten copy, double spaced. Any illustrations submitted should be in duplicate, one copy to be an inked drawing but without lettering, and the other to be lettered. Captions should be furnished for all illustrations.

STATEMENTS in these letters are expressly understood to be made by the writers; publication here in no wise constitutes endorsement or recognition by the American Institute of Electrical Engineers.

Some Types of Discussers

To the Editor:

The following are some types of discussers that I have met at technical meetings:

1. Instructed by the boss to say that his company has developed practically an identical gadget long ago, but discontinued making it because of the customers' complaints.

2. Condemns newfangled ideas in general and the paper by implication; says that the old things were not only fully sufficient, but actually better.

3. Says that his graduate students found the same result several years ago, but he did not deem it of sufficient importance to be published.

4. As one of the same gang, praises the paper and the author ex officio; "rubs in" a thing or two left out of the paper for commercial reasons.

5. Tells a long story of how he and Edison once tried to solve an entirely different problem. A sufferer from an irresistible "it-reminds-me" disease.

6. Pedantically puts dots over the author's *i*'s.

7. Reads a few paragraphs of general, irrelevant nature, to justify his traveling expenses.

8. The "smart alec" type: Repeats a part of the author's paper, in different and more obscure language, to show his learning.

9. Assumes a paternal attitude of an unappreciated pioneer, who at last sees his early struggles realized.

10. Shows lantern slides of a few mysterious curves on the screen, to indicate "us too."

11. Has nothing to say and says it with much zest: "Look, I'm here, aren't you glad to see me?"

12. In an ingratiating way mentions the beautiful climate of Los Angeles.

Very truly yours,

VLADIMIR KARAPETOFF (A'03, F'12)

(Consulting Engineer, Professor of Electrical Engineering, Cornell University, Ithaca, N. Y.)

Calculation of Resistance Steps in Starting Rheostats

To the Editor:

The calculation of the resistance steps in the starting rheostat, for a d-c motor has been considerably simplified by the use of graphical methods. Professor A. S. Langsdorf describes these methods in his "Principles of Direct Current Machines" and derives several useful relationships between the resistance values of the steps. Working along similar lines, I. Fagin, a student in our evening session, derived some expressions which I believe simplify the design of the starting box considerably.

In figure 1 is shown the usual construction used to determine the resistances of the steps. Here γ is the ratio of the peak

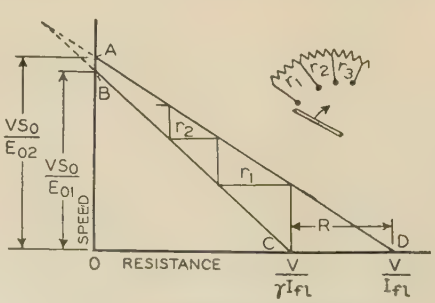


Figure 1. Graphical construction

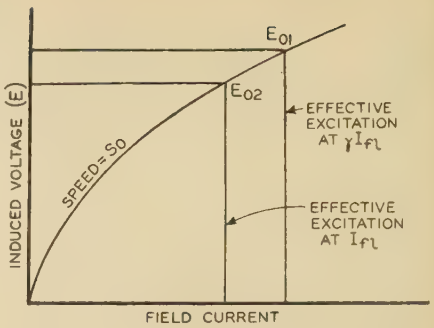


Figure 2. Saturation curve at speed S_0

current permissible to the full-load current experienced during the starting cycle. This diagram will give the steps r_1, r_2, r_3, etc. It should be noted that the ratio of the ordinates at the origin is given by the following expression:

$$\frac{OA}{OB} = \frac{E_{01}}{E_{02}} = K \qquad (1)$$

Essentially the ratio "K" is the ratio of the field flux existing at γI_{fl} armature amperes to the flux existing at I_{fl} armature amperes. It is obtainable from the saturation curve of the machine and may be greater than, smaller than, or equal to unity, depending on whether magnetizing, demagnetizing, or neutral conditions exist in the field. "K" may be obtained from the saturation curve as shown in figure 2.

From a careful consideration of the symmetries of the graphical construction, it may be shown that:

$$\frac{R}{r_1} = \frac{r_1}{r_2} \text{ etc.} = \frac{OD}{OC} \times \frac{OB}{OA} = \gamma \times \frac{1}{K} \qquad (2)$$

Also,

$$R = \frac{V}{I_{fl}} - \frac{V}{\gamma I_{fl}} = \frac{V}{I_{fl}}\left(\frac{\gamma - 1}{\gamma}\right) \qquad (3)$$

Using these relationships, it is now possible to design the steps in the starting box. The current ratio during starting is fixed at γ and the ratio K is found from the saturation curve, or estimated, if need be. The resistance R is computed from equation 3. The steps in the starting box are then obtained as follows:

$$r_1 = \frac{K}{\gamma} R$$

$$r_2 = \frac{K}{\gamma} r_1$$

$$r_3 = \frac{K}{\gamma} r_2$$

etc., and steps are added until:

$$r_1 + r_2 + r_3, \text{ etc.} = \frac{V}{\gamma I_{fl}}$$

By means of this procedure, the starting box may be calculated expeditiously for any type of direct current motor, shunt, compound, or series, without the necessity of constructing a scale diagram.

Very truly yours,

JOHN RAGAZZINI (A'33)

(Tutor, College of The City of New York, New York, N. Y.)

Personal Items

G. W. Thaxton (M'36) has been appointed chief engineer of the Rural Electrification Administration, Washington, D. C. Mr. Thaxton was born in Lake, Miss., in 1894, and received the degree of bachelor of science in electrical engineering from Mississippi State College in 1916. He was instructor in electrical engineering and assistant superintendent of the college generating plant at Mississippi State College, State College, Miss., 1916–17, and spent the following year as electrical assistant, United States Signal Corps, New York, N. Y. From 1918 to 1920 he was employed in the electrical engineering department of the Tennessee Coal, Iron, and Railroad Company. He was assistant professor of electrical engineering at Georgia School of Technology, Atlanta, from 1921 to 1924. During the next four years he was a special sales engineer for Westinghouse Electric and Manufacturing Company. In 1928 he was engaged in setting up operating organization and procedure for the Mississippi Utilities Company, after which he became agent for banking interests in acquiring and unifying various southern public-utility plants and systems. Out of these efforts was developed the Mid-South Public Service Company, of which Mr. Thaxton was vice-president and general manager, and later president, and from which he withdrew in 1931 to private consulting practice. In 1933 he became division engineer for the Tennessee Valley Authority at Tupelo, Miss., also serving as Mississippi district manager of the Electric Home and Farm Authority. He was transferred to the Rural Electrification Administration in 1935, as regional engineer, and except for a leave of absence as consulting electrical engineer for Chase Brass and Copper Company, continued in that post until his recent appointment. He is a member of Tau Beta Pi.

C. F. Wagner (A'20, M'27) has received the 1938 AIEE national prize award for best paper in engineering practice for his paper "Unsymmetrical Short Circuits on Water-Wheel Generators Under Capacitive Loading." Mr. Wagner was born March 20, 1895, in Pittsburgh, Pa. He received the degree of bachelor of science in electrical engineering at Carnegie Institute of Technology in 1917, and later did graduate work at the University of Chicago. Since 1918 he has been with the Westinghouse Electric and Manufacturing Company, at East Pittsburgh, Pa., engaged on research and development problems in various departments. He was first in the material and process engineering department, and in 1924 was transferred to the newly organized transmission engineering department, where he continued until 1933. For the next two years he was engaged in the development of rectifiers and inverters in the research department, and as central station engineer 1935–38 carried on special studies on transmission problems. In 1938 he was appointed consulting transmission engineer, the position which he now holds. He is co-author of a book on "Symmetrical Components" and author and co-author of many papers on technical subjects, and has received the award of the George Montefiore Foundation. He is a member of the AIEE committee on power transmission and distribution, and a member of the American Standards Association and various subcommittees.

C. W. Kellogg (A'19, M'23) has been elected the first permanent salaried president of the Edison Electric Institute. Mr. Kellogg, who has been president of the Institute since 1936, is resigning as chairman of Engineers Public Service Company, New York, to devote his attention to the newly created position, but will continue to be active in the affairs of the companies of which he is a director. Born in Philadelphia, Pa., February 27, 1880, he studied electrical and mechanical engineering at Massachusetts Institute of Technology, receiving the degrees of bachelor of science in 1902 and master of science in 1903. Throughout his professional career he has been engaged in public-utility work, as manager, Edison Electric Illuminating Company of Brockton, Mass., 1905; manager, El Paso (Tex.) Electric Railway Company, 1905–14, and manager of Eastern Texas Electric Company properties in Beaumont and Port Arthur, 1911–14; manager, Mississippi River Power Company, Keokuk, Iowa, 1914–19. He was district manager of the midwest district of Stone and Webster, Inc., 1916–19, and from 1919 to 1925 was engineer and consultant in connection with eastern properties of the company, with headquarters in Boston, Mass. He was made president of the newly organized Engineers' Public Service Company, New York, N. Y., in 1925, and in 1933 became chairman of the board.

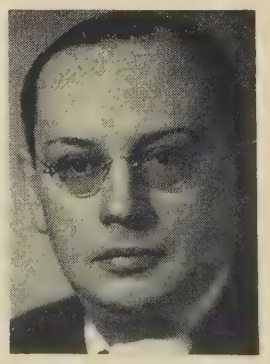
K. S. Wyatt (A'32) co-author of the paper "Mechanical Uniformity in Paper-Insulated Cables" with D. L. Smart (A'37) and J. M. Reynar, has received the 1938 AIEE national prize award for best paper in theory and research. Mr. Wyatt was born in Cambridge, Mass., September 24, 1900. He attended Mount Allison University, Sackville, N. B., Canada, receiving the degrees of bachelor of arts (1921) and bachelor of science in 1922, and later did graduate work at Harvard University and at the University of Toronto, in the latter case on a fellowship from the National Research Council of Canada. He was an assistant research chemist for the Carborundum Company, Niagara Falls, N. Y., in 1922–23. The Detroit Edison Company, Detroit, Mich., employed him in 1928 as research engineer on cable insulation. He continued in that position until 1938, when he became technical director of the Enfield Cable Works, Ltd., Enfield, England, where he is responsible for technical developments in design, manufacture, and installation, and also directs research. Mr. Wyatt is a member of the American Chemical Society and has been associated with a number of national committees on cables and insulation. He is author and co-author of many papers on cable insulation.

H. S. Bennion (M'27) has been elected vice-president and managing director of the Edison Electric Institute, New York, N. Y. He was formerly assistant managing director. Mr. Bennion was born in Vernon, Utah, in 1889, and is a graduate of the United States Military Academy (1912) and the United States Engineering School (1915). From 1915 to 1920 he was with the United States Army, with engineer troops at Galveston, Tex., 1915; with the military survey of Luzon, Philippine Islands, 1915–17, being in charge of the survey the latter part of that time; commander of the First Battalion, Second Engineers, American Expeditionary Forces, 1917; chief of Camouflage Service, AEF, 1917–19; engi-

H. S. BENNION

C. W. KELLOGG

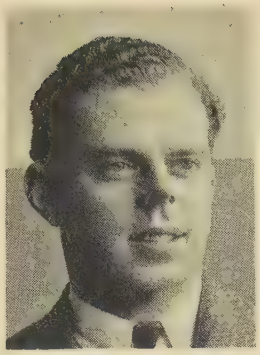
K. S. WYATT



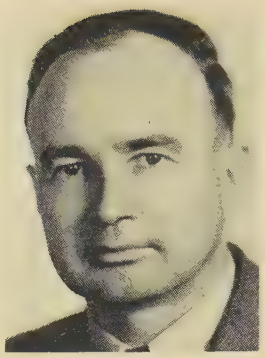
C. F. WAGNER

G. W. THAXTON

S. J. ROSCH



D. L. SMART



C. F. BOWMAN

neering services in connection with road work, supplies, sales, United States Liquidation Commission, 1919–20. He was assistant chief engineer, Federal Power Commission, Washington, D. C., 1920–24, and during the next two years district engineer of the fourth Mississippi district at New Orleans, La., and member of the United States Spillway Board. He became director of engineering for the National Electric Light Association, New York, N. Y., in 1926, and assistant managing director in 1932, continuing in that position when that organization was succeeded by the EEI.

D. L. Smart (A'37) co-author of the paper "Mechanical Uniformity of Paper-Insulated Cables" with K. S. Wyatt (A'32) and J. M. Reynar, has received the 1938 AIEE national prize award for best paper in theory and research. Born in Boston, Mass., March 4, 1903, Mr. Smart received the degree of bachelor of science in mechanical engineering at Purdue University in 1925. From 1925 to 1927 he was employed by Consumers Power Company, first as a junior engineer at the Milwaukee (Mich.) plant, then with the personnel department at that plant and Garfield substation, Flint, Mich., and finally as combustion engineer at Grand Rapids, Mich. During the next two years he was power plant combustion engineer for the Chevrolet Motor Company, Detroit, Mich. Since 1929 he has been with the research department of the Detroit Edison Company, engaged in materials testing and special research on problems related to electrical insulation. He has been head of the mechanical division of the research department since 1937. He is a member of the American Society of Mechanical Engineers and of the Engineering Society of Detroit.

C. F. Bowman (A'24, M'30) has been made chief engineer for the Montana Railroad and Public Service Commission, with headquarters in Helena. Mr. Bowman graduated from the University of Nebraska in 1923 with the degrees of bachelor of arts and bachelor of science in electrical engineering, and received the degrees of master of science in electrical engineering from Purdue University in 1928, and of electrical engineer from Montana State College in 1932. He was an instructor in electrical engineering at Purdue University, Lafayette, Ind., from 1923 to 1929, when he became assistant professor of electrical engineering at Montana State College, Bozeman. He was later given the rank of associate professor and held that position until his present appointment. He also maintained a consulting engineering practice. He is chairman of the AIEE Montana Section.

S. J. Rosch (A'15) has received the 1938 AIEE national prize award for initial paper for his paper "The Current-Carrying Capacity of Rubber Insulated Cables." Mr. Rosch, who is manager, insulated products development, Anaconda Wire and Cable Company, Hastings-on-Hudson, N. Y., has been associated with the cable industry for 28 years. He is a member of the American Standards Association, the American Society for Testing Materials, International Association of Electrical Inspectors, Insulated Power Cable Engineers Association, American Transit Association, and author of many articles on technical subjects.

E. I. Green (A'23, M'30) with co-author C. W. Green (A'10, M'26) has received honorable mention in the 1938 AIEE national prize award for best paper in engineering practice, for the paper "A Carrier Telephone System for Toll Cables." Mr. Green was born in St. Louis, Mo., in 1895, and received the degree of bachelor of arts at Westminster College in 1915. Later he did graduate work at the University of Chicago and in 1921 received the degree of bachelor of science in electrical engineering from Harvard University. He began his engineering career in 1920 with the General Electric Company at Pittsfield, Mass., and in 1921 entered the department of development and research of the American Telephone and Telegraph Company, New York, N. Y., engaging in development work on carrier telephone and telegraph systems. In 1934 he became associated with the Bell Telephone Laboratories, where he is at present a carrier telephone engineer. He is a member of the Institute of Radio Engineers and the Acoustical Society of America, and author and co-author of various technical papers.

H. W. Wahlquist (M'36) with co-author T. A. Taylor (A'30, M'36) has received honorable mention in the 1938 AIEE national prize award for initial paper for the paper "Noise Co-ordination of Rural Power and Telephone Systems." Mr. Wahlquist was born in Duluth, Minn., in 1895, and received the degrees of bachelor of science (1921) and electrical engineer (1922) from the University of Minnesota. He was employed by the Twin City Electric Company, Minneapolis, Minn., from 1922 to 1925, when he became an assistant engineer for the Northern States Power Company of Minneapolis. He represented the company in the Minneapolis Joint Use Investigation, and the following year, as assistant engineer for the National Electric Light Association, represented the power industry in the Elmira (N. Y.) Joint Use Investigation. He continued with the NELA until it was succeeded by the Edison Electric Institute, and is now an assistant engineer for the latter, engaged particularly with the problem of inductive co-ordination of power and communication systems. He was a member of the joint committee on development and research of the Edison Electric Institute and the Bell Telephone System.

L. R. Mapes (M'29, F'37) general manager, state area, Illinois Bell Telephone Company, Chicago, has been elected president of the Western Society of Engineers. A native (1892) of Middletown, N. Y., Mr. Mapes received the degree of electrical engineer from Columbia University in 1913. He was employed in the engineering department of the American Telephone and Telegraph Company, New York, until 1925, when he was transferred to the Illinois Bell Telephone Company as building and equipment engineer in charge of design and construction of telephone buildings and switchboards. In 1928 he was made chief engineer for the Chicago area and held that position until 1938 when he became general manager of the state area. Mr. Mapes is a director of the AIEE, and has also been chairman of the Chicago Section (1932–33) and a member of the committee on transfers (1934–36). He has been successively chairman of the electrical section, a trustee, and a vice-president of the Western Society of Engineers, before his election as president.

N. S. Braden (A'09, M'20) has been appointed vice-chairman of the board of Canadian Westinghouse Company, Ltd., Hamilton, Ont., Canada. He has been a vice-president of the company since 1919. Mr. Braden was born in Indianapolis, Ind., June 15, 1869, and attended Whitman College, Walla Walla, Wash. He was employed as an apprentice in 1892 by the Jenney Electric Motor Company, and later became a construction and sales engineer for the company at Cleveland, Ohio. In 1899 he became a sales engineer with the Cleveland office of the Westinghouse Electric and Manufacturing Company, and in 1903 was appointed district manager of the same office. He was made manager of the sales department of Canadian Westinghouse Company, Ltd., in 1904 and continued in that position until he was appointed third vice-president in executive charge of all commercial activities of the company.

T. A. Taylor (A'30, M'36) co-author of the paper "Noise Co-ordination of Rural Power and Telephone Systems" with H. W. Wahlquist (M'36), has received honorable men-

tion in the 1938 AIEE national prize award for initial paper. Mr. Taylor was born in Brooklyn, N. Y., in 1906 and graduated from Harvard University in 1928 with the degree of bachelor of science in electrical engineering. From 1928 to 1934 he was an engineer in the department of development and research of the American Telephone and Telegraph Company, New York, N. Y., engaging in field and laboratory work on inductive co-ordination of power and telephone systems, and acting as a member of the joint committee on development and research of the Edison Electric Institute and the Bell Telephone System. In 1934 he became a member of the technical staff of the Bell Telephone Laboratories, New York, continuing his work on inductive coordination. He is a member of Tau Beta Pi.

J. D. Kennedy (A'06) general telephone sales manager of Western Electric Company, New York, N. Y., will retire September 1, 1939. Mr. Kennedy graduated in engineering from Cornell University in 1898 and the following year became associated with Western Electric as a telephone engineer in New York. He has been with the company continuously ever since. He supervised the central office equipment engineering force in Chicago, was later transferred to Philadelphia, where he was in charge of distribution, and in 1918 returned to head the merchandise organization of the Hawthorne Works at Chicago. For four years he had charge of engineering all switchboard equipment made for the Bell System by Western Electric. He became head of the distributing department for the western half of the United States in 1926, and in 1927 assumed his present position in charge of the company's national distribution organization.

J. A. Kahn (A'21) has been made commercial vice-president of General Electric Supply Corporation, Salt Lake City, Utah. He was formerly Rocky Mountain district manager there. Mr. Kahn was born in Morrison, Ill., in 1872. He has been associated with the electrical industry since 1918, when he became connected with the Capital Electric Company, Salt Lake City, of which he was first general manager and later president. He had been district manager of the General Electric Supply Company in Salt Lake City for 11 years before his present appointment. He was one of the founders of the Rocky Mountain Electrical Cooperative League, predecessor of the Electrical League of Utah, and its first president.

William McClellan (A'04, F'12) has been made president of the Union Electric Company of Missouri, with headquarters at St. Louis. Doctor McClellan, who holds the degrees of bachelor of science (1900) and doctor of philosophy (1903) from the University of Pennsylvania, has been associated with that institution as instructor, dean of the Wharton School of Finance and Commerce, and trustee. He has been an executive of the Campion-McClellan Company, the firm of Paine, McClellan, and Campion, the Cleveland Electric Illuminating Company, McClellan and Junkersfield, Stone and Webster Engineering Corporation, and William McClellan and Company, Ltd. He resigned the position of president of the Potomac Electric Company, Washington, D. C., to accept his present appointment. He has been a manager, vice-president, and president of the AIEE, and is president of the American Engineering Council.

R. G. Warner (A'19, M'20) has been appointed to the engineering staff of the United Illuminating Company, New Haven, Conn. He was formerly assistant professor of electrical engineering at Yale University, New Haven. Mr. Warner received the degrees of bachelor of philosophy (1914) and electrical engineer (1920) from Yale University. From 1914 to 1916 he was with the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., in the student course and later as switchboard engineer. He became an instructor in electrical engineering at Yale in 1916 and continued in the department until his recent appointment. He has been electrical engineer for the Connecticut Public Utilities Commission since 1930, and has also been a consulting engineer for several private companies. He is past chairman (1931–32) of the AIEE Connecticut Section, and a member of Sigma Xi and Tau Beta Pi.

R. W. Sorensen (A'07, F'19) has received the 1938 AIEE national prize award for best paper in public relations and education, for his paper "The Economic Status of the Engineer." Doctor Sorensen is professor and head of the department of electrical engineering at California Institute of Technology, Pasadena. He is a director of the AIEE, a past vice-president, chairman of the committee on Student Branches, and member of the Edison Medal committee and the committee on economic status of the engineer. A biographical sketch of Doctor Sorensen appeared in the October 1938 issue, page 434.

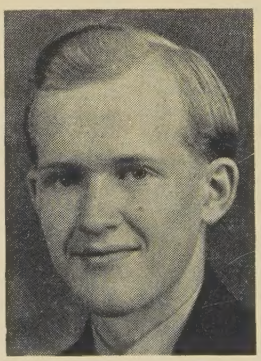
C. W. Green (A'10, M'26) co-author of the paper "A Carrier Telephone System for Toll Cables" with E. I. Green (A'23, M'30), has received honorable mention in the 1938 AIEE national prize award for best paper in engineering practice. A native (1884) of Waukegan, Ill., Mr. Green graduated in electrical engineering from the University of Wisconsin in 1907 with the degree of bachelor of science. He taught in the electrical-engineering department of Massachusetts Institute of Technology from 1907 to 1917, first as instructor, and later as assistant professor. During the World War he served in the United States Army, attaining the rank of major. He was a telephone engineer for the Western Electric Company 1919–24, and since 1924 has been with the Bell Telephone Laboratories, Inc., New York, N. Y. His present position is carrier telephone engineer. He is a member of Tau Beta Pi.

J. L. C. Löf (Enrolled Student) graduate student at Massachusetts Institute of Technology, has received the 1938 AIEE national prize award for Branch paper, for his paper "A Method for Determining the Efficiencies of Small Motors From the Heat Due to Eddy Currents." Mr. Löf was born in Denver, Colo., December 11, 1915. He received the degree of bachelor of science in electrical engineering from the University of Denver and is studying for the degree of master of science in electrical engineering at Massachusetts Institute of Technology.

Arch Robison (A'12, M'20) has been appointed chief engineer for the Public Utilities Commission of Ohio, with headquarters at Columbus. After graduating in electrical engineering at the University of Minnesota in 1909, Mr. Robison was employed in hydroelectric projects and mining in Montana. In 1918 he became assistant construction superintendent on the United States Nitrate Plant at Muscle Shoals, Ala., for the J. G. White Engineering Corporation, and continued in engineering activities for that company and others until he became vice-president and general manager of the Central Ohio Light and Power Company, Findlay, at its organization. In 1938 he became city manager of Celina, Ohio, giving up that position to accept his present appointment.

F. H. Lane (M'23, F'37) manager, engineering division, Public Utility Engineering and Service Corporation, Chicago, Ill., has been elected third vice-president of the Western Society of Engineers. Mr. Lane studied electrical and mechanical engineering at the Lewis Institute, Chicago, and received the degree of bachelor of science in 1904. He was employed in engineering capacities by H. M. Byllesby and Company and its successor, the Byllesby Engineering and Man-

J. A. KAHN



J. L. C. LÖF

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R. W. SORENSEN

agement Corporation, from 1904, becoming manager of engineering and construction of the latter in 1917, and continuing in his present position after the formation of the successor company, Public Utility Engineering and Service Corporation, in 1936. He is a director of the AIEE and a member of the American Society of Mechanical Engineers.

A. H. Kidder (A'29) with co-author F. R. Ford (A'19, M'28) has received first prize in the James H. McGraw awards of the Edison Electric Institute, for the paper "Increased Loading of Apparatus and Lines Permits Practical Economies." Mr. Kidder is assistant engineer of system planning, transmission, and distribution, Philadelphia Electric Company, Philadelphia, Pa. He received the degrees of bachelor of science (1922) and master of science (1923) in electrical engineering from Massachusetts Institute of Technology, and spent a year in the compressor engineering department of the General Electric Company. Since 1923 he has been associated with the Philadelphia Electric Company, giving special attention to transmission problems.

E. G. Fox (A'12, M'20) vice-president, Freyn Engineering Company, Chicago, Ill., has been elected second vice-president of the Western Society of Engineers. Mr. Fox graduated in electrical engineering at the University of Wisconsin in 1908 and held engineering positions with various electrical manufacturing concerns until 1920, when he became a power and electrical engineer for the Freyn Engineering Company. From 1928 to 1933 his headquarters were in Leningrad, USSR, where he was concerned with the development of the iron and steel industry. He became a vice-president in 1934. He is a member of the Association of Iron and Steel Engineers, and author of books on technical subjects.

I. A. Yost (A'36) has been appointed manager of engineering of the lighting division of Westinghouse Electric and Manufacturing Company, with headquarters at Cleveland, Ohio. After graduating from Pennsylvania State College in 1924 with a bachelor of science degree in electrical engineering, Mr. Yost entered the Westinghouse student course at East Pittsburgh, Pa., and the next year was assigned to the illuminating engineering section. He has continued with the lighting division ever since, with headquarters at South Bend, Ind., 1927–30, and at Cleveland since 1930. Before his present appointment he was assistant manager of engineering of the lighting division.

F. R. Ford (A'19, M'28) co-author of the paper "Increased Loading of Apparatus and Lines Permits Practical Economies" with A. H. Kidder (A'29), has received first prize in the James H. McGraw awards of the Edison Electric Institute. Mr. Ford is assistant inside plant engineer, Philadelphia Electric Company, Philadelphia, Pa. He graduated in mechanic arts (1914) and in electrical engineering (1916) from Drexel Institute, and in 1916 entered the special training course of the Philadelphia Electric Company. Except for service in the United States Army during the World War, he has been with the company ever since.

F. E. Young, Jr. (A'32) has been appointed apparatus and supplies sales manager of the Salt Lake City (Utah) branch of Westinghouse Electric Supply Company. Mr. Young received the degree of bachelor of science in electrical engineering from the University of Utah in 1930, and entered the student course of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. He has been a sales engineer for Westinghouse Electric Supply Company in Salt Lake City for some years prior to his present appointment.

Charles Dunn (A'36) has been appointed an associate electrical engineer on the Bonneville Dam Project, Portland, Ore. Since 1930 he has been electrical engineer with the Central Arizona Light and Power Company, Phoenix, Ariz. Mr. Dunn received the degrees of bachelor of electrical engineering (1927) and electrical engineer (1937) from the University of Arkansas. He was a student engineer for the Commonwealth Edison Company of Chicago 1927–28, and field engineer for the Public Service Company of Northern Illinois 1928–30.

J. F. Calvert (A'27, M'35) has received honorable mention in the 1938 AIEE national prize award for best paper in theory and research for his paper "Amplitudes of the Magnetomotive Force Harmonics for Fractional Slot Windings." Doctor Calvert is head of the electrical-engineering department at Northwestern University, Evanston, Ill. A biographical sketch of him appeared in the April issue, page 183.

J. A. Mayer (A'37) has been appointed assistant general power apparatus sales manager of the Graybar Electric Company, with headquarters in New York, N. Y. He was formerly manager for the company at Cleveland, Ohio. Mr. Mayer has been associated with the Graybar company since 1920, and before that time was a division equipment engineer for the Southwestern Bell Telephone Company, St. Louis, Mo.

H. L. Hildenbrand (A'38) has been made New York sales representative of the Esterline-Angus Company, Inc., manufacturers of electrical instruments. He has been associated with the sales department of that organization since 1933, formerly as district representative for western Pennsylvania, eastern Ohio, and West Virginia.

T. S. Teague (A'37) has been employed as high-voltage laboratory assistant by the Locke Insulator Corporation, Baltimore, Md. He was formerly a student engineer for General Electric Company, Schenectady, N. Y.

Obituary

Arthur Edwin Kennelly (A'88, M'99, F'13, HM'33) professor emeritus of electrical engineering at Harvard University and Massachusetts Institute of Technology, died April 18, 1939, in Boston, Mass. Doctor Kennelly was past-president (1898–1900) of the AIEE, Edison Medalist, and recipient of numerous honors in the United States and other countries. A complete biographical sketch will appear in the August issue.

Frederick Horace Tibbetts (M'30) consulting engineer, San Francisco, Calif., died in August 1938, according to report recently received. Born in Oshkosh, Wis., April 28 1882, he received the degrees of bachelor of science (1903) and master of science (1905) from the college of liberal arts, University of Pacific, and bachelor of science (1904) and master of science (1906) in civil engineering from the University of California. His engineering career began in 1904 as assistant on United States irrigation and drainage investigations. From 1906 to 1911 he was an instructor and later assistant professor of civil engineering at the University of California, Berkeley. In 1909 he became a member of the firm of Haviland and Tibbetts, civil engineers, later the Haviland, Dozier, and Tibbetts Construction Company, in general charge of design work, and of the San Francisco office. He continued with the company until 1917, when he set up private practice in San Francisco as a civil and consulting engineer, serving as chief engineer on numerous reclamation, irrigation, and power projects in California, Arizona, Nevada, and Oregon; on hydroelectro power developments in Alaska for the Anchorage Light and Power Company; consulting engineer on various projects including the Roosevelt Water Conservation District of Arizona, Santa Clara Valley Water Conservation District, and for the Alameda Sugar Company and the Union Sugar Company. He was a member of the American Society of Civil Engineers, Sigma Xi, Tau Beta Pi, and Sigma Iota Phi.

Edward Louis Hirt (A'18) mechanical engineer, Canadian and General Finance Company, Ltd., Toronto, Ont., Canada, died May 28, 1939. He was born in Arlington, Mass., January 3, 1890, and received the degree of mechanical engineer from Columbia University in 1913. He began his engineering career as an apprentice at the Westinghouse Electric and Manufacturing Company at East Pittsburgh, Pa., and the same year became an inspector for the Pearson Engineering Corporation, New York, N. Y. In 1914 he went to Tremp, Spain, as assistant to the resident engineer, for the Ebro Irrigation and Power Company, Barcelona. For the next two years he was employed as master mechanic by the Toronto Power Company at Niagara Falls, Ont., Canada, and in 1916 he became assistant to the vice-president of the Pearson Engineering Corporation, in charge of the engineering department. After a few months as mechanical engineer for Shewan Tomes and Company, New York, purchasing equipment for export to the Orient, he was employed by the Bethlehem Shipbuilding Corporation, South Bethlehem, Pa., on application of electric welding to shipwork. In 1921 he was employed as a mechanical engineer by the Canadian and General Finance Company, which acts as engineers and purchasing agents for a group of public-utility companies in Brazil and Mexico, and continued with that organization until his death.

William Clifford Stevens (A'11, M'13, F'20) secretary and vice-president in charge of engineering, Cutler-Hammer, Inc., Milwaukee, Wis., died May 15, 1939. He was born

in Portland, Maine, April 20, 1884, and graduated in mechanical engineering at Cornell University in 1906. Following graduation he was employed by the Cutler-Hammer company in the engineering department at Milwaukee, and except for a few months with the Bridgewater Woolen Mills Company, Bridgewater, Vt., in 1910, was associated with that organization continuously until his death. From 1907 to 1910 he was sales engineer for the company's Pittsburgh office, and from 1910 to 1912 special sales engineer at Milwaukee. During 1912 he was district manager of the Chicago office, and in 1913 he was made eastern district manager, with headquarters in New York. He returned to Milwaukee in 1917 as sales manager and held that position until 1924, when he was made head of the development department. Since 1930 he had been a director, vice-president in charge of engineering, and secretary, with headquarters at Milwaukee.

Charles Messick (A'03, M'13) engineer and patent attorney, New York, N. Y., died at Brentwood, N. Y., May 25, 1939. He was born in New York, N. Y., January 27, 1879, and studied at Brooklyn Polytechnic Institute. His first electrical work was with the New York Electric Vehicle Transportation Company, after which he was employed by the Riker Electric Vehicle Company, and by the Bates Manufacturing Company, both of New York. In 1901 he was employed by the United Telpherage Company, New York, as superintendent of construction and erection, and later became a selling engineer for the Chicago district. He later set up his own office in New York as electrical engineer and patent attorney, and was chief engineer for the Electrical Conveying Machinery Company. During the World War he was a lieutenant in the United States Navy, passing on patents for the Naval Consulting Board. Since the war he had continued practice as a patent attorney in New York.

John Theodore Mountain (A'04, M'13, F'20) retired, died April 16, 1939, in Glencoe, Ill. Born November 28, 1878, at Chicago, Ill., he received the degree of bachelor of science in electrical engineering from the University of Michigan in 1899. From that year until his retirement in 1935, he was associated with the Chicago Edison Company and its successor the Commonwealth Edison Company, first in the construction department, then for two years in the statistical department. His next position was apprentice substation operator. In 1904 he became a load dispatcher, and in 1906 chief load dispatcher. In 1910 he was made assistant to the chief operating engineer, a position which he held until 1935. At retirement, he was assistant service manager. He was a member of the Western Society of Engineers.

Charles Henry Kramer (A'20, M'36) chief power supervisor, Cincinnati Gas and Electric Company, Cincinnati, Ohio, died February 28, 1939. He was born May 7, 1882, in Cincinnati, and studied at the Ohio Mechanics Institute there. After being employed as switchboard operator and electrician by the South Covington and Cincinnati Street Railway Company he was transferred to the Union Gas and Electric Company as switchboard operator in 1913. He was appointed electrical foreman in 1916, and in 1920 became chief load dispatcher. He became chief power supervisor of the Union Gas and Electric Company in 1932 and when the company consolidated with Cincinnati Gas and Electric Company in 1936 continued in that position with the latter organization.

Elbert N. Renshaw (A'18) engineer in charge of the construction program of the American Telephone and Telegraph Company, Ltd., died in New York, N. Y., May 16, 1939. He was born in Brooklyn, N. Y., April 22, 1879, and took courses in electrical work from the YMCA and by correspondence. In 1893 he was employed by the American Telephone and Telegraph Company and had been engaged in engineering activities for the company ever since, working in plant extension, building and equipment, and construction program departments. At the time of his death he had charge of the general construction program for the company's entire system.

James Howe Finley, Jr. (A'27) supervisor of personnel methods, New York Telephone Company, Albany, died at Syracuse, N. Y., March 10, 1939. Born in Somerville Mass., September 13, 1903, he received the degrees of bachelor of science and master of science from Massachusetts Institute of Technology. From 1923 to 1926 he did cooperative work with the General Electric Company, and in 1926 he became an engineer for the Arkansas Light and Power Company, Little Rock. He was later employed by the International Telephone and Telegraph Company at Havana, Cuba, and then became associated with the New York Telephone Company at Albany, first as transmission engineer and later as supervisor of personnel methods.

Ralph Lawbaugh Belshe (A'35) engineer, Petroleum Rectifying Company of California, Los Angeles, died May 24, 1939. He was born September 21, 1905 at Eldon, Mo., and received the degree of bachelor of science in electrical engineering from Washington University in 1928. From 1928 to 1931 he was employed in electrical and physical research on petroleum emulsions by the Tretolite Company, Webster Groves, Mo. He was transferred to the Petroleum Rectifying Company of California as research engineer on its affiliation with the Tretolite Company, and at the time of his death was engaged in layout and operation of electrical dehydrating equipment. He was a member of Sigma Xi.

Membership

Recommended for Transfer

The board of examiners, at its meeting on June 15, 1939, recommended the following members for transfer to the grade of membership indicated. Any objection to these transfers should be filed at once with the national secretary.

To Grade of Fellow

Borch, Frederik, assistant electrical engineer, Cleveland Electric Illuminating Company, Cleveland, Ohio.
Edwards, E. J., manager, plant engineering department, General Electric Company, Cleveland, Ohio.
Fick, C. W., district engineer, General Electric Company, Cleveland, Ohio.
Harrington, C. A., member of electrical engineering staff, Cleveland Electric Illuminating Company, Cleveland, Ohio.
Hertz, S. S., executive director, Copper Wire Engineering Association, Washington, D. C.
Marti, O. K., engineer-in-charge, rectifier equipment, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.
Shoemaker, G. T., president, The United Light and Power Service Company, Chicago, Ill.
Weinbach, M. P., professor of electrical engineering, University of Missouri, Columbia.

8 to Grade of Fellow

To Grade of Member

Berkey, W. E., research engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Blackstone, W. S., design engineer, The McKay Machine Company, Youngstown, Ohio.
Burgwin, S. L., research engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Chapman, H. N., chief engineer, Woodward and Tiernan Printing Company, St. Louis, Mo.
Croft, W. H., design engineer, Central Arizona Light and Power Company, Phoenix, Ariz.
Denault, C. L., section engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Dyer, G. A., outside plant engineer, Southwestern Bell Telephone Company, Dallas, Tex.
Fitzgerald, A. E., instructor in electrical engineering, Massachusetts Institute of Technology, Cambridge.
Franklin, R. F., electrical engineer, General Electric Company, Schenectady, N. Y.
Friend, A. W., assistant professor of physics, West Virginia University, Morgantown.
Hanna, C. R., electromechanics division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Hayman, W. C., engineer, cable department, General Electric Company, Schenectady, N. Y.
Himebrook, F. S., electrical engineer, The General Industries, Inc., Elyria, Ohio.
Holman, H. R., engineer, National Carbon Company, Inc., Cleveland, Ohio.
Lewis, W. A., director of electrical engineering, Cornell University, Ithaca, N. Y.
Morris, R. C., operating superintendent, Union Electric Company of Missouri, St. Louis.
Nelson, L. V., power supervisor, Union Electric Company of Missouri, St. Louis.
Oplinger, K. A., research engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Outt, J. R., electrical engineer, General Electric Company, Fort Wayne, Ind.
Peterson, G. H., telephone engineer, Bell Telephone Laboratories, Inc., New York, N. Y.
Ranson, L. R., development engineer, Clark Controller Company, Cleveland, Ohio.
Rorke, C. B., assistant electrical engineer, Canadian and General Finance Company, Toronto, Ont., Can.
Rose, J. J., assistant engineer, New York and Queens Electric Light and Power Company, Flushing, N. Y.
Schlemmer, O. C., plant supervisor, Cincinnati and Suburban Bell Telephone Company, Cincinnati, Ohio.
Sparks, V. P., designing engineer, Ohio Brass Company, Mansfield.
Strom, A. P., research engineer, Westinghouse Electric and Manufacturing Company, Trafford, Pa.
Toepfer, A. H., research engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Vernon, H. H., industrial department, General Electric Company, Schenectady, N. Y.
Walters, T. R., section head, General Electric Company, Pittsfield, Mass.
Winograd, H., electrical engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

30 to Grade of Member

Applications for Election

Applications have been received at headquarters from the following candidates for election to membership in the Institute. Names of applicants in the United States and Canada are arranged by geographical Districts. If the applicant has applied for direct admission to a grade higher than Associate, the grade follows immediately after the name. Any member objecting to the election of any of these candidates should so inform the national secretary before July 31, 1939, or September 30, 1939, if the applicant resides outside of the United States or Canada:

United States and Canada

1. NORTH EASTERN

Cariapa, C., Jr., International General Electric Company, Schenectady, N. Y.
Clark, E. S., Springfield Trade School, Springfield Mass.
Frankl, F., Freydberg Bros., Inc., Stamford, Conn.
Hilding, J. H., Electric Boat Company, Groton, Conn.

2. MIDDLE EASTERN

Delfs, J. M., 220 High Street, Canfield, Ohio.
Dowd, I. F., Toledo Industrial Rubber Company, Toledo, Ohio.
McDaniel, R. E., General Electric Company, Philadelphia, Pa.
Patton, G. J. K., Bell Telephone Company of Pennsylvania, Philadelphia.
Penzickes, C., Philadelphia Navy Yard, Philadelphia, Pa.
Reiff, L. S., Metropolitan Edison Company, Reading, Pa.
Shombert, G., Jr., Allis-Chalmers Manufacturing Company, Pittsburgh, Pa.
Strosser, R. J., Cleveland Electric Illuminating Company, Cleveland, Ohio.
Venegas, C., 404 East Ninth Street, Chester, Pa.

3. NEW YORK CITY (TERRITORY OF THE NEW YORK SECTION)

Gorin, E., 955—47th Street, Brooklyn, N. Y.
Quist, A. H., Jr., Radio Engineering Laboratories, Long Island City, N. Y.
Short, A. L., United States Electric Motors, Brooklyn, N. Y.
Whiting, M. T., Public Service Electric and Gas Company, Hackensack, N. J.

4. SOUTHERN

Abbott, L., Tennessee Valley Authority, Knoxville, Tenn.
Dunagan, G. C., Tennessee Valley Authority, Guntersville Dam, Ala.
Leppert, J. H., Tennessee Valley Authority, Guntersville Dam, Ala.
McCoy, J. H., Tennessee Valley Authority, Wilson Dam, Ala.
O'Brien, F. J., Tennessee Valley Authority, Knoxville, Tenn.
Olivier, L. J., Louisiana Power and Light Company, New Orleans.
Porter, J. O., Columbia Military Academy, Columbia, Tenn.

5. GREAT LAKES

Boesenberg, H. H., Public Service Company of Northern Illinois, Maywood, Ill.
Owen, C. B., Aluminum Company of America, Chicago, Ill.
Patterson J. D., Commonwealth Edison Company, Chicago, Ill.
Peirce, G. R., University of Illinois, Urbana.

6. NORTH CENTRAL

Torvick, E. B., American Telephone and Telegraph Company, Denver, Colo.

7. SOUTH WEST

Brown, H. A., New Mexico State College of Agricultural & Mechanical Arts, State College, N. Mex.
Loutzenheiser, H. C., Raymond H. Reed Engineering Company, Abilene, Kans.
Sargl, G. (Member), Stone and Webster Engineering Corporation, Beaumont, Tex.
Stalnecker, F. I., El Paso Electric Company, El Paso, Tex.

8. PACIFIC

Beeman, K. C., Phelps Dodge Copper Products Corporation, Los Angeles, Calif.
Cox, J. L., Nevada-California Electric Corporation, Bishop, Calif.
Marshall, R. E., Nevada-California Electric Corporation, El Centro, Calif.
Moran, G. E., Southern California Edison Company, Ltd., Alhambra, Calif.
Nevin, P. P., Southern California Edison Company, Ltd., Alhambra, Calif.
Poniatoff, A. M., Pacific Gas and Electric Company, San Francisco, Calif.

9. NORTH WEST

Sisk, W. R., Otis Elevator Company, Spokane, Wash.
Stalker, W. N., Otis Elevator Company, Spokane, Wash.
Wheeler, L. E., City of Seattle, Wash.

10. CANADA

Biskeborn, H. W. (Member), Phillips Electrical Works, Ltd., Brockville, Ont.
Connors, L. McC., Canadian General Electric Company, Toronto, Ont.
Rose, C. J., International Metal Industries, Toronto, Ont.

Total, United States and Canada—45

Elsewhere

Ananthanarayanan, C. N., Government Electricity Department, Coimbatore, Madras, India.
Bedil, S. D., Punjab Public Works Department, Lahore, Punjab, India.
Nagabhushanam, K., Power and Light, Chikmaglur, Mysore State, India.
Setty, K. S. (Member), C. N. T. Institute, Vepery, Madras, India.
Watton, E. B., British Thomson-Houston Company, Ltd., Willesden, London, England.

Total, elsewhere—5

Addresses Wanted

A list of members whose mail has been returned by the postal authorities is given below, with the addresses as they now appear on the Institute record. Any member knowing of corrections to these addresses will kindly communicate them at once to the office of the secretary at 33 West 39th St., New York, N. Y.

Barnes, Maurice T., Coan, Va.
Coleman, Irwin M., 581 Academy St., New York, N. Y.
Ebert, Kenneth W., 776 N. Cass St., Milwaukee, Wis.
Ember, Theodore, 4011 Springdale Ave., Baltimore, Md.
Fies, John, Dallas Power & Light Co., Dallas, Texas
Garvey, Fred A., Brownsville, Tenn.
Hall, John R., c/o Patrick Tyrrell Drilling Co., Cotton Exchange Bldg., Houston, Texas
Hicks, William A., 1862 Central Ave., Augusta, Ga.
James, George Hazard, Jr., 7 Meikle Ave., Newport, R. I.
Johnson, James Steven, 213 Buckingham St., Hartford, Conn.
Lewis, Rodney C., 310 Garland Ave., Takoma Park, Md.
McCarthy, C. C., c/o Westinghouse Electric and Manufacturing Co., 814 Ellicott Square, Buffalo, N. Y.
McWhorter, W. Allen, Jr., 4549 Lake Park Ave., Chicago, Ill.
Modisette, M. H., 4514—16th St., N. E., Seattle, Wash.
Ratajczak, Frank X., 1635 Delaware Ave., Wyomissing, Pa.
Strauss, Walter A., 39 West 69th St., New York, N. Y.
Taylor, C. Max, 1801 Monroe St., Endicott, N. Y.
Tolman, Clarence M., 310 N. Aurora St., Ithaca, N. Y.

18 Addresses Wanted

Engineering Literature

New Books in the Societies Library

Electrical engineers may be interested in the following new books, which are among those recently received at the Engineering Societies Library, New York, N. Y. Unless otherwise specified, books listed have been presented by the publishers. The Institute assumes no responsibility for statements made in the following summaries, information for which is taken from the preface of the book in question.

HIGH-FREQUENCY ALTERNATING CURRENTS. By K. McIlwain and J. G. Brainerd. Second edition. New York, John Wiley and Sons, 1939. 530 pages, illustrated, 9 by 6 inches, cloth, $6.00. Presents the mathematical analysis of the operation of electric circuits at high frequencies as a course for advanced electrical engineering students, to be accompanied by practical laboratory work. Topics include thermionic vacuum tubes, electric-wave filters and transmission lines, amplification, modulation, detection, etc. The co-ordination of quantities and units in electromechanical-acoustic systems is considered in the final chapter. Chapter bibliographies.

ELECTRIC CIRCUITS AND WAVE FILTERS. By A. T. Starr. Second edition. New York and Chicago, Pitman Publishing Corporation, 1938. 476 pages, illustrated, 9 by 6 inches, cloth, $6.00. The opening chapters present fundamental mathematical processes, alternating-current theory, and electric circuit theory. Design information is given for resistances, capacitors, and coils, including transformers, preceding a discussion of wave filters. Separate chapters are devoted to low-pass, high-pass, and band-pass filters. Attention is also given to acoustic analogies, electro-acoustics, and transients in networks. Long appendices summarize the information about filters, and the characteristics of band-pass filters are expressed in a nomogram.

EINFÜHRUNG IN DIE SIEBSCHALTUNGSTHEORIE DER ELEKTRISCHEN NACHRICHTENTECHNIK. By R. Feldtkeller. Leipzig, S. Hirzel, 1939. 174 pages, diagrams, etc., 9 by 6 inches, paper, 10.80 rm.; bound, 12 rm. Deals with the theory of filters in communication work. The various types are considered, with mathematical analyses and explanatory diagrams. Two chapters are devoted to the problems of balancing and damping.

THE DECLINE OF MECHANISM IN MODERN PHYSICS. By A. d'Abro. New York, D. Van Nostrand, 1939. 982 pages, diagrams, etc., 9 by 6 inches, cloth, $10.00. Reviews the historical development of physical theories from their beginnings to the modern quantum theory. Particular stress is laid on Heisenberg's "principle of uncertainty," and on the reasons which compelled physicists to abandon mechanical interpretations. The three parts of the book deal, respectively, with the fundamentals of natural philosophy, with a review of mathematics and the more important classical physical theories, and with a discussion of the various quantum theories and the doctrine of causality.

CITY PLANNING, WHY AND HOW. By H. M. Lewis. New York and Toronto, Longmans, Green and Company, 1939. 257 pages, maps, etc., 9 by 6 inches, cloth, $2.50. Discusses the need and advantages of planning for future growth or change in a municipality, and indicates the part the average citizen can play in this development.

APPLIED PHOTOGRAMMETRY. By R. O. Anderson. Second edition. Ann Arbor, Mich., Edwards Brothers, 1939. 190 pages, illustrated, 8 by 5 inches, cloth, $2.50 (10 copies or more, $2.00 per copy). As in the previous edition, methods for determining the correct scales of aerial photographs are given, together with an analytical radial-line method of control, which takes into account both relief and tilt. In the revision, the theory has been extended and a chapter added on the graphical-ray method of control. The present volume constitutes a textbook as well as a reference work for the application of aerial photography to various types of surveys.

THE SUPERHEATER IN MODERN POWER PLANT. By D. W. Rudorff. London, Sir Isaac Pitman and Sons; New York, Pitman Publishing Corporation, 1938. 293 pages, illustrated, 9 by 6 inches, cloth, $6.00. Aims primarily to present actual ways and means of superheating saturated steam. Most of the chapters contain descriptive material on various types of superheaters. There are also chapters on superheater computation and regulation and on the mechanical design and operation of superheaters. Tables on superheated steam are appended. The book is based on a series of articles which appeared in *The Engineering and Boiler House Review.*